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VAN DEN BRUEL (W. E.). **Un ravageur de l'épinard d'hiver : *Tyroglyphus dimidiatus* Herm. (*longior* Gerv.).**—*Bull. Inst. agron. Gembloux* **9** no. 1–4 pp. 81–99, 3 figs., 20 refs. Gembloux, 1940. (With Summaries in Dutch, German and English.)

When the first picking of outer leaves was made in the autumn of 1938 from a crop of winter spinach growing in two unheated glasshouses in Belgium, the inner leaves were found to be injured so severely that no more could be gathered and the value of the crop was reduced by about 80 per cent. The plants did not grow after the end of November. The blades of the inner leaves were very short, crumpled and deformed, though the petioles were normal, and the epidermis was sometimes perforated with little holes surrounded by corky tissue. The leaves finally turned black, but the plants were killed by a sudden and severe frost in December. They bore very large numbers of mites of the genus *Tyrophagus* (*Tyroglyphus*, *sens. lat.*) and their eggs, and it was eventually concluded that the damage was due to the feeding of these mites and not to a virus, since the symptoms differed from those of various diseases of spinach, which are briefly discussed, and were not induced in healthy plants by rubbing or inoculating them with the sap of affected ones.

A description is given of the mite, with notes on its classification and life-history, and its habits are discussed from the literature. It belongs to the species that has been recorded in the European literature as *T. dimidiatus*, Herm. [*cf. R.A.E.*, A **25** 706, etc.] and the author uses this name on the assumption that *T. longior*, Gerv., is a synonym of it [but *cf.* **31** 69], though he points out that some consider both to be synonyms of *T. putrescentiae*, Schr. [*cf.* **31** 157]. The causes of its great abundance and possible methods of control are discussed with reference to previous observations on it [**17** 638 ; **18** 601 ; **25** 706]. There was no obvious difference between the infested houses and neighbouring uninfested ones, and it is possible that the mite was introduced when a heavy application of cow manure was made in the house, which was primarily a vinery, and that its increase was favoured by the humidity produced in the atmosphere by watering and a fall in outside temperature. Attempts should therefore be made to ensure that manure introduced into vineries is free from infestation ; the manure should be carefully buried, excessive humidity avoided, and the houses carefully cleaned and all vegetable débris burned or covered with earth. Infestation of winter spinach develops too late in the season for the sun to have much effect, but the soil should be exposed to the light as much as possible. Heating cannot be used when it is necessary to keep the vines dormant, but humidity could probably be lowered by ventilation. Spreading a thin layer of dry soil or peat and watering the beds from below instead of from the surface might also be beneficial. Fumigation with naphthalene was found effective by Speyer [**18** 601], and experiments showed that strong spinach plants were not affected by 24 hours' exposure to the dose recommended by him. If this treatment cannot be applied, sprays of lime-sulphur or white oil directed into the hearts of the plants and over the soil and base of the walls twice at an interval of six days are probably the best substitutes.

Colorado Beetle in England during the War.—*Agriculture* **52** no. 5 pp. 210–215, 3 refs. London, 1945.

The only records of the occurrence of the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] in Britain prior to those reviewed in this paper were in the Tilbury district of Essex in 1901 and 1933–34. Following its eradication in 1934 [*R.A.E.*, A **24** 264], one live adult was discovered in a field crop in the same area in 1936 and dead ones in soil in Sussex in 1936 and in Essex and Kent in 1936 and 1937. This suggested that fairly extensive migration from the Continent had taken place during the autumn of 1935, but that all or most of the migrants had failed to survive. An investigation of the Tilbury area in the summer of 1938 showed that the beetle was not breeding there and justified the conclusion that it had not established itself. Isolated adults were found in ships or near the coast in 1936, 1938 and 1939, and a survey was accordingly made in 1939 and 1940 in certain districts on the south coast, but no beetles were found. In 1940, 16 were intercepted at Whitstable, northern Kent, in a vessel coming from Brittany.

Infestations were found in 1941 in four places in Devon (three of them inland and one 25 miles from the south coast) and one each in Dorset and Glamorgan. The areas were cleared and carbon bisulphide was injected into the soil, and in some cases potato crops around them were treated with arsenical spray. All crops within five miles of infested fields were examined. In choosing precautionary measures for 1942, the possibility that the inland infestations were the result of deliberate introduction or of infestations undetected during the previous season and perhaps arising from beetles inadvertently brought in luggage by the troops was borne in mind. In addition to increasing publicity and inspecting as many crops as possible in the south-west, crops within five miles of the fields involved in 1941 were sprayed, and potato-growing was restricted as far as possible to fields that had carried potatoes in the previous year. This was designed to prevent the occurrence of isolated potato plants among cereal crops and to facilitate spraying. Infestations were discovered at one place in Devon, three within a small area in north-western Dorset and one in Wiltshire. As in the previous year, all adults and immature stages that could be found were collected and carbon bisulphide was injected into the soil. One outbreak was found in Wiltshire in 1943 and the usual measures were taken. No outbreaks were found in 1944 on potato crops, but several individuals were introduced in ships and aeroplanes.

NORRIS (K. R.). **Experimental Determination of the Influence of the Red-legged Earth Mite (*Halotydeus destructor*) on a Subterranean Clover Pasture in Western Australia.**—*Bull. Coun. sci. industr. Res. Aust.* no. 183, 36 pp., 4 figs., 18 refs. Melbourne, 1944.

Records of damage by *Halotydeus destructor*, Tucker, to vegetables in South Africa and vegetables and subterranean clover (*Trifolium subterraneum*) in southern Australia [*cf. R.A.E.*, A **32** 261] indicate that it becomes abundant only in regions of summer drought and winter rainfall. Its distribution in Australia corresponds fairly closely with the areas in which subterranean clover is an important pasture plant, and damage is most pronounced in a region between the 16 and 25 in. isohyets in the south-west of Western Australia. The climate of this region, and the composition and pests of the pastures are discussed, and the seasonal history of *H. destructor* and the extent of the damage that it causes to various common pasture plants are reviewed. The mite is active in late autumn, winter and spring and passes the summer, when the temperature is too high for it and most suitable food-plants are dead, in the egg stage [*cf.* **29** 142]. The eggs hatch in late April and May, and a large population develops and frequently causes severe damage to seedlings. The numbers are quickly reduced, probably by shortage of cover, and remain small during the winter in most pastures, though serious injury is sometimes caused to subterranean clover. They increase again in September, but foliage damage is then less serious, as growing conditions are favourable, and the mites die off in late October or early November, when the pasture plants wither and die.

Experiments were carried out in 1939–41 to show the yields of foliage and seeds from three series of isolated plots [*cf.* **32** 262] of which all had been sown with Wimmera rye-grass (*Lolium rigidum*) and two series with subterranean clover at 4½ and 9 lb. seed per acre, respectively ; some plots in each series were kept free from *H. destructor* and others bore normal or heavy infestations throughout the season or from early September onwards. Some of the main results have already been noticed [**32** 140]. Foliage sampling showed a general trend towards reduction in the yield of subterranean clover and total yield on plots sown with that crop as severity of mite attack increased; the mites produced no significant effect on the total yield in the absence of subterranean clover. The total yield increased with the increase in the rate of sowing of subterranean clover. The yield of *Erodium botrys*, the most important non-leguminous plant on the plots, was measured in 1940 and 1941, but the results obtained were inconsistent. The yield of native clovers (almost exclusively *Trifolium procumbens*) on plots containing no subterranean clover was significantly reduced by heavy mite attack when it occurred throughout the season, but not when it began in September; this was possibly due to seedling damage, as the later foliage is relatively immune from attack. The flowers of subterranean clover were attacked comparatively little and the burs and seeds not at all, but both the quantity of seed and the weight of individual seeds were decreased by mite attack on the foliage, which reduced the length of life and the vigour of the plants.

PATEL (J. S.). **Indian Central Jute Committee. Annual Report of the Agricultural Research Scheme for the Year 1942–43.**—51 pp., 2 figs., 2 graphs. Calcutta, 1943. **Indian Central Jute Committee. Annual Report of the Agricultural Research Scheme for the Year 1943–44.**—38 pp. Calcutta, 1944.

Sections of these reports (pp. 24–28 and 19–26) deal with work on insect pests of jute (*Corchorus olitorius* and *C. capsularis*) in Bengal in 1942–43 and 1943–44, respectively. In continued studies in the first year of the bionomics of *Apion corchori*, Mshl. [*cf. R.A.E.*, A **29** 446], adults survived in the laboratory for an average of 75·3 days under normal conditions and for up to 35 days when water was provided but not food. The information given on oviposition and control has been noticed from a subsequent account [**34** 117]. Infestation by this weevil was severe during the first year, and the extent of attack on both species of jute was about the same, though its intensity was lower in *C. olitorius*. Observations in both years showed that parasitism of the larvae [*cf.* **34** 117] increased gradually during the crop season and declined towards the end; it was highest in the withered tops. The two parasites present were *Bracon* (*Microbracon*) sp. and an undetermined Chalcidoid [Miscogasterid], and adults survived in the laboratory for up to 64 and 36 days, respectively. During the second year, the Braconid appeared in low-lying areas as early as March and increased in numbers until July, after which it gradually declined. Females caged with larvae of *Apion* placed in hollows excavated in jute stems oviposited within a day of emergence; the egg was laid on or near the larva, which was first paralysed. Active, almost full-grown larvae were selected for oviposition, and larvae that were already parasitised were rarely attacked. The female sometimes fed on the body-fluid of the larva after paralysing it, but in that case did not oviposit on it. Individual females laid up to 27 eggs, with an average of 18, and deposited as many as eight in one day. The progeny of unfertilised females were all males. The larvae fed externally on their hosts and pupated in silken cocoons in a corner of the cage. The egg, larval and pupal stages lasted 1, 2 and 4–5 days, respectively. No alternative hosts were found, but the parasite was successfully reared in larvae of *Calandra granaria*, L., though the females would not attack them unless they were placed in jute stems. The prepupae of *Bracon* in their cocoons were themselves attacked by a parasite.

Laphygma exigua, Hb., is stated in the first report to be common in low-lying areas on jute plants less than one foot high and to be favoured by drought early in the season. In studies on its bionomics, oviposition began 2–8 days after emergence and continued for 2–11 days. The average number of eggs laid per female was 461·7, and the maximum was 1,278 ; they were deposited on the lower surface of the leaves. The egg, larval and pupal stages lasted 2, 13–16 and 5–7 days, and males and females survived for averages of 8·1 and 11·8 days. Three larvae were found to be heavily parasitised by Nematodes, and three insect parasites were recorded. They included *Euplectrus gopimohani*, Mani [**32** 393], the bionomics of which were studied in the laboratory in the second year. The females oviposited soon after emergence on larvae in the second and third instars, and the numbers of eggs per female ranged up to 55 and averaged 35·2. The numbers laid on single hosts ranged up to 9 but were usually 3–4. Unfertilised females produced male offspring. The egg, larval and pupal stages lasted 2, 2 and 4–5 days, respectively ; the larvae fed externally on their hosts and pupated in loose silken cocoons beneath their shrivelled bodies. This Eulophid was also reared on larvae of *Prodenia litura*, F., and *Scopula emissaria*, Wlk. ; *P. litura* is present almost throughout the year on various crops and could therefore be used to rear it in large numbers for release early in the season. In experiments in the first year on the control of *L. exigua*, a dust of calcium arsenate and lime (1 : 10) was effective, and the use of til [*Sesamum orientale*] as a trap-crop gave very good results.

Attack by *Diacrisia obliqua*, Wlk., was light at Dacca in the first year, and larvae of the first generation were controlled by hand-collection, but severe outbreaks were reported from six other districts, in three of which the crop was completely destroyed. In laboratory experiments on the control of *Anomis* (*Cosmophila*) *sabulifera*, Gn., dusts of lime with calcium arsenate, lead arsenate or Paris green (10 : 1) and sprays of 3 lb. lead arsenate, 10 lb. lime and 2 lb. molasses or 1½ lb. calcium arsenate alone in 100 gals. water proved effective.

The bionomics of the jute Buprestid, the identity of which is at present uncertain, were studied in the second year. The larvae make zigzag mines in the leaves, and the adults feed on the leaf margins. Mating took place shortly after emergence, and the eggs were deposited singly in small punctures at the edge of the upper surface of the leaf, mostly near the tip ; several may be laid on one leaf. The egg, larval and pupal stages lasted 3, 6–7 and about 4 days, respectively, and the adults survived for up to 33 days. Infestation in the field was much heavier on *Corchorus capsularis* than on *C. olitorius*. Jute was infested from March until the end of the season, self-sown jute during the winter and *Triumfetta rhomboidea* almost throughout the year ; breeding occurred on the latter, though jute was preferred.

Pest control methods were demonstrated on a semi-commercial scale in the second year in a district near Dacca, where *Anomis sabulifera*, mites and a bacterial disease were very prevalent. Three generations of *A. sabulifera* were observed, of which the second was the most injurious. The first was controlled in the experimental fields by providing perches for insectivorous birds, hand-collection and the application of insecticides, and the incidence of the second was much lower than in the untreated area. *Sesamum orientale* was effective as a trap-crop for *L. exigua* in some cases, but the trap-crop and the jute were attacked to an equal extent in others. A dust of sulphur and lime (1 : 3) is recommended against the mites, but it was found necessary to apply it also to borders and hedges in order to prevent re-infestation.

[NEGI (P. S.).] **Entomological Section.**—*Rep. Indian Lac Res. Inst. Namkum 1943–44* pp. 13–26. Ranchi, 1944.

Work on the parasites of the Lepidoptera predacious on the lac insect [*Laccifer lacca*, Kerr] at Namkum (Bihar) [*cf. R.A.E.*, A **31** 295] was confined in 1943–44 to *Bracon* (*Microbracon*) *greeni*, Ashm., a parasite of *Eublemma* *amabilis*, Moore. Attempts were made to rear it on a number of alternative hosts in the laboratory, but none was so suitable as *E. amabilis*. Of 16 tested, only *Corcyra cephalonica*, Staint., *Platyedra gossypiella*, Saund., *Scirpophaga nivella*, F., *Emmalocera depressella*, Swinh., and an unidentified larva boring in the seeds of *Pongamia glabra* were attacked; parasites were reared from all of these except *E. depressella*. Alternative hosts in lac domes covered with tissue paper were more readily parasitised when the paper was smeared with the body-fluid of larvae of *Eublemma amabilis* or sprinkled with their excreta or with finely-powdered seed lac. The results of experiments to determine the differences in populations and parasitism of *E. amabilis* produced during four crop periods when natural parasitism was supplemented by liberations of *B. greeni* are given in tables; in general they confirm previous findings that the releases are of some value [*loc. cit.*].

In laboratory experiments to investigate heat treatment for the control of larvae and pupae of *E. amabilis* and *Holcocera pulverea*, Meyr., the average exposures necessary to kill both species were 22 hours at 40–42°C. [104–107·6°F.] and six hours at 44–46°C. [111·2–114·8°F.]; a treatment period of 22 hours would probably be impracticable for the villagers. Large-scale trials in which stick lac in a closed store-room was exposed to different ranges of temperature at different seasons of the year, the results of which are given in a table, indicated that exposure to 50–61°C. [122–141·8°F.] for periods exceeding four hours may be effective in destroying the predators without impairing the quality of the shellac.

The ninth generation of the parthenogenetic strain of *L. lacca* [*cf. loc. cit.*] began to develop normally.

MALLAMAIRE (A.). **Note sur l'emploi de la pastèque, *Citrullus vulgaris*, Schrad. (Cucurbitaceae) dans la préparation des appâts empoisonnés.**—*Bull. ent. Res.* **36** pt. 4 pp. 423–424, 3 refs. London, 1946.

Watermelons (*Citrullus vulgaris*) were largely used in 1943 in baits against *Schistocerca gregaria*, Forsk., in the Sahel region of French West Africa as a substitute for wheat bran, which was not available. The bait is prepared by sprinkling the finely-chopped fruits with sodium fluosilicate at the rate of about 4 lb. per 100 lb. pulp, and should be applied within a day of preparation, to avoid fermentation. The inclusion of molasses or other sweetening agent is unnecessary, and the great attractiveness of the fruit also compensates for the rather poor coverage given by the bait.

MOUTIA (L. A.) & MAMET (R.). **A Review of Twenty-five Years of economic Entomology in the Island of Mauritius.**—*Bull. ent. Res.* **36** pt. 4 pp. 439–472, 2 pls., 9 figs., 76 refs. London, 1946.

The authors briefly describe the geology and climate of Mauritius and give an account, based on the literature, of work that has been done there for the control of various insect pests, chiefly those attacking crops. The work has consisted largely in the introduction of parasites and predators from other countries, and in this connection it is recommended that future introductions should be made only from countries in which conditions resemble those in Mauritius. The successful control of the noxious weeds, *Opuntia* spp., by introduced Coccids of the genus *Dactylopius* is also reviewed.

Progress Reports from Experiment Stations Season 1943–1944.—176 pp., 1 pl., 1 fig., refs. London, Emp. Cott. Gr. Corp., 1945. Price 3s.

The pests of cotton occurring at various Experiment Stations during 1943–44 are discussed as in previous years [*R.A.E.*, A **33** 87]. W. G. Wells (pp. 7–8, 20–22) reports that three generations of *Heliothis armigera*, Hb., attacked cotton in Queensland, in December, January and February, respectively, but that only the first was important, as dry conditions in January and February made it unlikely that squares then on the plants would mature. Oviposition was always greatest on the crop that was producing squares most freely at the time, and the greatest yields were obtained on soils that had been under cultivation for the least time. *Empoasca maculata*, Evans, which becomes numerous on late-planted crops, has been particularly injurious during recent years, especially in scrub areas characterised by red volcanic soils. *Platyedra scutigera*, Hold., which is primarily a pest of late-maturing bolls, is becoming less important as scrub areas in which its native food-plants occur are progressively eliminated and the area under ratoon and standover cotton decreased. ***Earias huegeli***, Rogenh., causes losses that vary in extent from year to year.

The first part of a report from Barberton, South Africa, by D. MacDonald, D. F. Ruston & H. E. King (pp. 25–32, 1 pl.) includes the results of further investigations [*cf. loc. cit.*] on the relation between hairiness of the leaves of cotton and its resistance to Jassids. The high inverse correlations found between the number of Jassids and the average density of hairs reaching a suitable minimum height on the leaves of strains of *Gossypium hirsutum* and hybrid cotton derived from *G. hirsutum* × *barbadense* indicated that a simple measure of lamina hairiness can account for most of the variation in Jassid infestation between plants, and preliminary investigations showed that midrib hairiness, which is associated with hairiness of the lamina, is also important [*cf.* **33** 387]. In the second part, H. E. King & D. F. Ruston (pp. 32–36) describe the technique employed in studying the hairiness of the leaf lamina. Observations on growing plants of two varieties showed that the average density of the hairs on main-stem leaves increases steadily on successive nodes with the growth of the plant, but that their average length reaches a maximum at about node 14 and then decreases slightly. If leaf hairiness is the main factor in Jassid-resistance, young plants should be more susceptible to attack than older ones, and, in an experiment with three varieties, the average numbers of Jassids per 100 leaves, which are shown in a table, were far greater on late-planted cotton than they were at the same time on the same varieties planted two months earlier [*cf.* **29** 517]. The formation of the hairs is complete at an early stage of leaf development, and further increase in leaf-size merely reduces their density.

G. S. Cameron (pp. 54–55) reports that the American bollworm [*H. armigera*] was again scarce in Southern Rhodesia. *Dysdercus* spp., which caused little damage, decreased in the early part of April and became numerous again towards the end of the month, when *D. fasciatus*, Sign., and *D. superstitiosus*, F., were about equally abundant, but less so than *D. intermedius*, Dist. The Sudan bollworm [*Diparopsis castanea*, Hmps.] did much damage early in the year, but Jassids, though numerous, caused little or none, possibly owing to the cultivation of resistant strains of cotton.

It is stated in the course of a report by R. R. Anson, R. L. Knight & S. H. Evelyn from the Anglo-Egyptian Sudan (pp. 58–85) that *Helopeltis* sporadically causes localised damage to cotton in Equatoria, where *Dysdercus*, *Oxycarenus*, *Empoasca*, *Earias insulana*, Boisd., and *Platyedra gossypiella*, Saund., all occur, and that damage due to *Empoasca* is sometimes very severe in the Northern Gezira and quite serious in the Gash delta, where almost all the pests of cotton known in the Sudan are present. *Gossypium amourianum*, like *G. thurberi* [**33** 87], appears to be highly resistant to *P. gossypiella*, and experiments on the crossing of both with Sakel [*G. peruvianum* × *barbadense*] are in progress.

J. D. Jameson & P. E. Weatherley (p. 97) report that in variety trials at Serere, Uganda, one of two hairy cottons included to test their reactions to *Lygus* showed more resistance to Jassids than any strain previously tested in Uganda and less injury due to *Lygus* than any other strain under observation, although it was quite severely attacked. Its lint yield was significantly greater than that of any other strain, but this may be due to varietal fruiting capacity.

Reports are given from four districts in Tanganyika Territory. J. E. Peat (pp. 108–109) states that in spite of the general dryness of the year, damage by Jassids was severe at Ukiriguru and other areas of the Lake Province, probably owing to heavy April rains. Early populations of *Dysdercus* spp. comprised mainly *D. superstitiosus* and *D. nigrofasciatus*, Stål, but fair numbers of *D. fasciatus* were present by the middle of June. The amount of staining was greater than in most seasons. Treatment with a sodium-arsenite bait-spray [*cf.* **33** 88] caused no improvement in yield and no reduction in staining, and the treated plots were attacked by Aphids throughout the season. A small outbreak of *Heliothis armigera* occurred in February, and Aphids were troublesome on the young cotton. A. N. Prentice states in the course of his report from the Lubaga Station (Shinyanga district) (pp. 110–123) that damage due to Jassids was generally light in the district, and that *H. armigera*, *Earias insulana* and probably *E. biplaga*, Wlk., were present but unimportant at the Station. *Ancistrotermes latinotus*, Silv., which had not previously been recorded in Tanganyika, caused severe damage over about four acres of an apparently uniform eight-acre field. Young and seemingly healthy seedlings were attacked at or below ground level, and few recovered. Termites commonly cause less important damage to cotton in this district, and the remaining cotton on the farm was attacked in the usual way at the flowering stage by termites that made earth tunnels up the stems and did not always kill the plants. *D. fasciatus* caused serious injury, but *D. cardinalis*, Gerst., *D. superstitiosus* and *D. nigrofasciatus* were comparatively rare. These are the only species of the genus known in the district, a previous record of *D. intermedius* [**30** 84] being erroneous. Attack by *Calidea dregii* var. *apicalis*, Schout., was heavier than usual and persisted until August. In further tests with sodium-arsenite bait-sprays [*cf.* **33** 88] applied in the form of coarse droplets by means of a short-handled mop against stainers, the yields of seed-cotton from treated plots averaged 236 lb. per acre, of which 6 per cent. was stained, and those from control plots 116 lb., of which 44 per cent. was stained. Good results were also obtained in two small fields, and it is concluded that poisoning is a practical method of controlling excessive stainer damage at Lubaga. Aphid attack was heavy on treated cotton, possibly owing to the poisoning of predators.

A. G. Bebbington & A. H. McKinstry (pp. 124–134) give an outline of the general situation with regard to cotton in the Eastern Province in 1941–42, and state that *Empoasca* spp. were present in 1943, but caused serious damage only to plants growing in unfavourable circumstances. *Heliothis armigera* (*Chloridea obsoleta*, F.) bred on a succession of maize crops and spread from them to cotton [*cf.* **33** 88] ; it did not occur on sorghum, but infested *Cajanus cajan* (*indicus*) from the middle of June until early July, and it is possible that a certain amount of egg-laying was diverted from cotton to this crop, as it is in flower at the same time. Infestation of cotton by *Platyedra gossypiella* began a month or more later on new land than on land on which cotton had been grown in the previous year, thus emphasising the need for complete and early uprooting and burning of the crop. *Earias* spp. were present from the beginning of flowering until late in the season, but were not of major importance ; they were the most numerous on cotton that had been seriously damaged by *H. armigera* and Capsids early in the season. The main species of *Dysdercus* recorded were *D. fasciatus*, *D. intermedius*. *D. cardinalis* and *D. nigrofasciatus*, of which the first three were the most important ; *D. superstitiosus* and *D. migratorius*, Dist., were represented by one example each. Late-planted cotton was less severely damaged by *Dysdercus* and *H. armigera* than that planted early, but when uprooting and burning were delayed in the hope of obtaining a late crop, extremely severe injury was observed in October pickings. The same authors (p. 136) state that observations in 1942 showed that the situation with regard to injurious insects in the Northern and Tanga Provinces resembles that in the Eastern Province, except with regard to *H. armigera*, which is probably favoured by the fact that maize is the staple food-crop instead of being one of several and which completely stripped many crops of bolls. In the southern portion of the district, where recovery is hindered by dry conditions, it was prevented by Capsids, but there was some recovery in the north owing to irrigation.

E. O. Pearson & B. L. Mitchell (pp. 145–153) report on investigations in the Lower River area of Nyasaland. Earlier laboratory and field tests [*cf.* **33** 89–91] had indicated that the best method of controlling *Diparopsis castanea* would be to grow an early-maturing crop that would be uprooted very much sooner than the crops grown at present, with the object of concentrating boll production into the time of year when a minimum of long-term (diapause) pupae are formed. Investigations were therefore carried out to confirm the previous results, to explore methods of overcoming the difficulty of producing early cotton interplanted with food-crops, and to test additional methods of minimising the survival of such long-term pupae as could still be formed. Owing to attack by larvae that resulted from moths from long-term pupae, flowers did not develop until the end of May, but as a result of good rains they were abundant until July, and a crop was harvested between late July and September.

In experiments continued over two years on the breeding of larvae at controlled temperatures, no long-term pupae were obtained from larvae that were the offspring of moths from long-term pupae when 200 larvae were kept at a temperature of more than 20°C. [68°F.] and a temperature range of less than 20°C. [36°F.], and 13 were kept at alternating temperatures with a daily range greater and a minimum temperature less than 20°C. Of 16 larvae that were the progeny of moths from short-term pupae and were kept under the first of these conditions, 15 gave rise to short-term pupae and one to a pupa that developed in 60 days. It is therefore concluded that, whereas there is no positive evidence that low or widely fluctuating temperatures induce the formation of long-term pupae, there is considerable evidence to show that, if temperatures are fairly high and fairly constant, as in the wet season in the field, long-term pupae are not formed, irrespective of the origin of the larvae or the food on which they develop. The age of the food eaten by the larvae did not determine the production of long-term pupae. The pupae produced early in the season again consisted almost entirely of short-term individuals ; the proportion of long-term pupae became large in June and was greatest in August–September. From pupae formed in May–August in 1943 and 1944, there was a peak of short-term emergences after 3–4 weeks and one of long-term emergences after about 18–20 weeks, but those formed in September and October included a considerable number with intermediate pupal periods of 1–3 months. Waterlogging continuously or intermittently for 1–4 weeks killed developing long-term pupae in their earthen cells and prolonged the pupal period of those that were quiescent by amounts of the same order as the total periods of submersion.

Field experiments are described that show that a considerable increase in the earliness and absolute yield of cotton interplanted with maize can be obtained by changes in the arrangement and planting date of the maize and the method of harvesting it. Experiments on cultivation and mulching in the dry season confirmed earlier observation that digging cotton fields immediately after uprooting, in July, causes a considerable reduction in the number of pupae that survive until the following season and showed that early digging, moderate mulching and the encouragement of weed growth in the later stages of the cotton crop were also effective, the population of living pupae on weedy plots at the end of the dry season being little more than a third of that on plots on which all plant residue was cleared and burnt after the cotton was uprooted.

W. E. Bond reports (pp. 159 and 161) that attack by *Helopeltis* was again severe in southern Nigeria [*cf.* **33** 91] and that *Empoasca* sp. is the most serious pest of cotton in the northern Provinces. A native cotton (*Gossypium peruvianum*) is resistant to leaf-curl [*Ruga gossypii* of Holmes], which is transmitted by *Bemisia* sp., but very susceptible to *Dysdercus* spp., which attack early crops most severely.

JARVIS (H.). **Carrot Root Aphid.**—*Qd agric. J.* **60** pt. 6 pp. 353–354, 1 fig. Brisbane, 1945.

Anuraphis tulipae, Boy., is found on carrots, and also on parsnip and a number of weeds, in many parts of Queensland. The Aphids usually occur on the roots, but sometimes infest the crowns of the plants and even the leaves if the weather is cloudy. As a result of infestation, the young leaves sometimes turn yellow, and the carrots are small and may be deformed. Alates are produced in spring and sometimes occur on the leaves, but winged males are rare. When carrots are not present, infestation is carried over on dock [*Rumex*]. The Aphids are tended by ants, which carry them from plant to plant, and carrots surrounded by ant mounds are almost always infested. Serious injury to the crop is caused only if attack occurs early in the season and the weather is cloudy for several weeks, so that the Aphids become abundant and congregate in the crowns of the plants. In such cases, a 3 per cent. nicotine dust should be applied at weekly intervals.

JARVIS (H.). **Beet Webworm.**—*Qd agric. J.* **60** pt. 6 pp. 355–357, 2 figs. Brisbane, 1945.

Beet is widely grown in market gardens in Queensland in autumn, winter and spring and is sometimes injured by *Hymenia recurvalis*, F. This Pyralid occurs on black pigweed [? *Portulaca oleracea*] during the summer, and when this weed dies down in autumn, the moths oviposit on beet. Damage is most severe on the first planting. The eggs are laid on the lower surface of the leaves, and the larvae skeletonise the leaves and sometimes feed on the exposed surface of the root. They pupate in cocoons in the soil near or on the root. The egg and pupal stages last 4–5 and about 7 days, respectively, and the life-cycle about 4 weeks.

Field evidence indicates that many of the larvae can be destroyed by dusting with a mixture of equal parts of lead arsenate and kaolin or talc. Treatment should be repeated 2–3 times at weekly intervals and should be concluded six weeks before harvest. Derris dust [*cf.* *R.A.E.*, A **30** 231] containing at least 1 per cent. rotenone can be substituted during the latter half of the growing period.

KELSEY (J. M.). **The Influence of Termite reproductive Castes on the Colony and on Control Measures.**—*N.Z. J. Sci. Tech.* **26** (B) no. 6 pp. 353–359, 3 figs., 4 refs. Wellington, N.Z., 1945.

Reproductive castes of three types occur in colonies of the subterranean termites, *Coptotermes acinaciformis*, Frogg., *C. frenchi*, Hill, and *C. lacteus*, Frogg. Those with wing stumps (primary reproductives) were the alates that are normally the founders of new colonies, those with wing buds are supplementary (second-form) reproductives that develop from nymphs in a fairly late stage, and those with no sign of wings are supplementary (third-form) reproductives that develop from younger nymphs. The first two forms have been found in New Zealand, and observations indicate that whereas the primary reproductives are probably unable to start a new colony in sound wood, although they can live in it when once established, the second-form reproductives can commence operations in sound timber. The latter, if they are present at all, are usually produced in fairly large numbers and appear to move freely about the nest; they reach maturity in a very short time, and though they cannot leave the parent nest, they can maintain or build up a colony either at the same time as the primary reproductives or instead of them, and might become the founders of new colonies and the means of dispersal over wider areas under certain conditions of disturbance. Termite detection, therefore, should not involve extensive probing or breaking of timbers, as the termites isolated by a definite break in tunnels or runways can build up a new colony once supplementaries are developed, provided that a suitable source of moisture is available. Inspections below ground-level have a very limited value and are even more likely to result in the development of new colonies from isolated portions of the old ones, as the termites already have contact with the ground.

The two main methods of attacking subterranean termites in New Zealand are to ignore the possible influence of supplementary reproductives and follow the runways back to the vicinity of the nest, treating any termites seen on the way; and to recognize the importance of supplementaries and treat in such a way that there is little likelihood of isolating part of the colony. The first has the advantages that dusting [*cf.* *R.A.E.*, A **32** 29] can better be carried out near the nest; that it is not necessary to wait for dry conditions in timber and runways, since the latter are used merely as a means to trace the infestation to its source; and that detection of nests is very much easier. Its disadvantages are that in most cases isolated pockets of termites would build up branch colonies; that it is difficult to trace colonies for any distance, owing to the presence of sealed roads and paths; and that if nests cannot be found it is necessary to rely on the dusting of runways, which are usually so damp that dusts cake on the walls and are ineffective. The second method reduces the chances of isolating portions of the colony, but has the disadvantages that dusting of points remote from the nest would not leave enough dust in the tunnels for the termites to carry it back to the nest; that dampness of points near the ground level would prevent their being dusted; that there would often be delay between detection and the occurrence of conditions suitable for treatment; and that detection is very difficult where infestations are weak. The first method is the better to remove the immediate threat of a strong colony, but may result in the establishment by isolated termites of new colonies that become important in 10–20 years, and it is considered that the second may give more permanent control, particularly if it is found that nymphs travel for long distances from the nests or that reproductives of the third form can be developed from foraging workers. These points require further investigation; nymphs have occasionally been observed about 30 ft. from where the nest was judged to be, but are not usually found far from the nest.

PEMBERTON (C. E.). **Entomology.**—*Rep. Comm. Exp. Sta. Hawaii. Sug. Pl. Ass. 1943–44* pp. 17–21. Honolulu, 1945.

Insect pests again caused little damage to sugar-cane in Hawaii during the year ending 30th September 1944 [*cf.* *R.A.E.*, A **32** 246]. No extension of the range of *Anomala orientalis*, Waterh., was noted, and the importance of *Rhabdoscelus obscurus*, Boisd., is being progressively reduced by the increasing use of a variety of sugar-cane that is highly resistant to it. *Bufo marinus*, which was introduced into Hawaii in 1932 [**21** 235], now occurs almost everywhere in the lowlands of the Territory and has undoubtedly played a part in the control of many insect pests. Tadpoles hatched in three days from eggs of this toad collected in May 1933 and completed their development in a month; some of the resulting adults were kept in cages, and seven were still alive in 1944, having consumed several hundred thousand insects during the 11 years *Laphygma exempta*, Wlk., and *Cirphis unipuncta*, Haw., were scarce and have not damaged sugar-cane in the Islands for several years. The decrease in their numbers is attributed to control by the introduced parasites, *Apanteles marginiventris*, Cress., *Meteorus laphygmae*, Vier., and *Blondelia* (*Eucelatoria*) *armigera*, Coq. [*cf.* **31** 474; **33** 250; **34** 2]. All three are established on the islands of Oahu, Maui and Hawaii, *Blondelia* and *Apanteles* on Kauai, and *Apanteles* on Molokai. These parasites also attack various caterpillars on common weeds and can thus maintain their numbers at times when *L. exempta* and *C. unipuncta* are absent.

During the year under review, 5,125 insects, of which 173 were alive, were found in Army and Navy aeroplanes arriving in Oahu from other regions. None of the living insects was of importance, but some of the dead ones represented species that do not occur in Hawaii and are pests elsewhere. A list of these is given.

HAYWARD (K. J.). **Las móscas blancas (Aleyrodidae) y su control.** [Aleurodids and their Control.]—*Circ. Estac. exp. agríc. Tucumán* no. 128, 8 pp., 5 figs. Tucumán, 1944.

The leaves of *Citrus* and other plants that grow in town parks, avenues and gardens and in hothouses in the Province of Tucumán, Argentina, are frequently infested by Aleurodids, of which the commonest on *Citrus* is *Aleurothrixus howardi*, Quaint. Some injury results from the loss of sap caused by their feeding, but far more from the deposition of honeydew, which favours the development of sooty moulds that prevent the leaves from functioning normally. In the country districts, Aleurodids are controlled by Hymenopterous parasites, predacious Syrphids and Coccinellids and entomogenous fungi, but these natural enemies hardly ever occur under the artificial conditions obtaining in towns and hothouses, in which treatment with insecticides is necessary. Those recommended include DDT in the form of Gesarol, which can be used as a dust or as a spray and is stated to remain effective for a considerable period.

KUSCHEL (G.). **Un gorgojo acuático del arroz argentino** *Lissorhoptrus bosqi* **n. sp. (Col. Curculionidae).** [*L. bosqi*, sp. n., an Argentine Rice Water Weevil.]—*Notas Mus. La Plata* **8** Zool. no. 71 pp. 305–315, 1 pl., 1 fig., 11 refs. La Plata, 1943.

Descriptions are given of the adults, larvae and pupae of *Lissorhoptrus bosqi*, sp. n., a water weevil that is injurious to rice in the Provinces of Entre Ríos, Santiago del Estero, Jujuy and Santa Fe, Argentina, together with characters distinguishing it from *L. simplex*, Say, and *L. oryzae*, Costa Lima [*cf. R.A.E.*, A **25** 232]. The adults are amphibious and feed on the leaves, but do not cause much injury; they were also observed feeding on leaves of grasses and a Cyperaceous plant. The eggs are deposited singly in the roots of the rice, and the larvae hatch in a week and feed on the roots, sometimes severing them completely. They become full-fed in 26–35 days or more and form mud cells, attached to the roots, within which they rest for about a week and then pupate; the adults emerge some 5–7 days later. Not more than two generations a year have been observed. In experiments, the adults were not affected by submersion for up to 96 hours, but the larvae died in 24 hours when kept in water not containing roots.

MONTE (O.). **Cultura do tomateiro especialmente as pragas e doenças e seu tratamento.** [The Cultivation of Tomato, with particular Reference to its Pests and Diseases and their Control.]—6th edn., 88 pp., illus., many refs. São Paulo, Chácaras e Quintais, 1945.

This publication contains a section (pp. 19–47) in which notes are given on the economic importance, appearance, bionomics and control of the principal insect pests of tomato in Brazil, with information on the natural enemies and alternative food-plants of some of them, and another (pp. 57–72) on the nature and use of several common insecticides and fungicides, with formulae and instructions for their application.

Bruner (S. C.) & Deschapelles (J. B.). **El picudo negro del platano.** [The Black Banana Borer.]—*Circ. Estac. exp. agron. Cuba* no. 82, [6] pp., 8 figs., 8 refs. Santiago de las Vegas, 1945.

Cosmopolites sordidus, Germ., was observed for the first time in Cuba in October 1944, when it was found on banana on a few estates in the Province of Havana. It had apparently been present for some time and was also observed on *Musa textilis* (Manila hemp) and *M. martinii*. Notes are given on its distribution, bionomics and control in other countries, the injury it causes to banana and the appearance of all stages, together with characters distinguishing the larvae, pupae and adults from those of the native weevil, *Metamasius sericeus*, Ol., which attacks only the injured parts of banana plants.

Wolcott (G. N.). **How to make Wood unpalatable to the West Indian Dry-wood Termite, *Cryptotermes brevis* Walker, III.**—*Caribb. Forester* **6** no. 4 pp. 245–266. Rio Piedras, P.R., 1945. (With a Translation in Spanish pp. 256–265 and a Summary in French.)

An account is given of further work in Porto Rico on the effectiveness of various organic and inorganic compounds in rendering wood resistant to attack by *Kalotermes* (*Cryptotermes*) *brevis*, Wlk. [*cf. R.A.E.*, A **32** 29; **33** 243]. The organic compounds were tested by immersing samples of wood of *Bursera simaruba* in solutions of different concentrations for ten minutes and then exposing them to the termites, and the results are shown in a table. Those that protected the samples for more than 100 days and, in brackets, the number of days for which protection was given were 0·5 and 1 per cent. pentachlorphenol (273 and 337, respectively), 1 per cent. hexachlorphenol (133), 2 per cent. tetrachlorphenol (116), 0·05 and 0·1 per cent. copper pentachlorphenate (108 and 111, respectively), undiluted quinoline (232), an undiluted mixture of meta- and para-cresols (220), 2 per cent. fluoranthene (360), and 1 and 2 per cent. pyrene (182 and 195, respectively). At 2 per cent. concentrations, DDT and the cadmium, copper and mercuric salts of a substituted cyclopentane propionic acid that is not yet generally available all afforded complete protection for the periods during which they were observed. The period was longest (over a year) in the case of DDT. At 1 per cent., however, DDT protected the wood for only 37 days [*cf.* **33** 244] and the other three compounds for only 11–14 days.

The relative value of copper, mercury, cadmium, zinc, iron, chromium, aluminium, antimony, lead and boron as repellents was tested by comparing the resistance of samples of *B. simaruba* that had been immersed for ten minutes in solutions of various salts of these metals at different concentrations with that of West Indian mahogany (*Swietenia mahagoni*). The concentrations that did and did not render the wood less attractive than the mahogany are given in a table. Wood impregnated with a solution containing 0·15 per cent. copper as copper sulphate was as resistant after two years as at the beginning of the test, and the termites did not even rest on the surface of another sample that was impregnated at the same time with a solution containing 0·2 per cent.; wood treated with one containing 0·1 per cent. was slightly attacked. Further tests indicated that fluorine is repellent to termites, and cadmium, zinc and cupric fluorides were more effective than copper sulphate; they gave complete protection at concentrations of 0·05 per cent. Cd and 0·01 per cent. Cu or Zn. The fluorides of aluminium, ferric iron and chromium were less satisfactory. A solution containing 0·02 per cent. copper as copper ortho- and pyro-phosphate protected the wood and did not darken its colour, as copper compounds at dilutions necessary for protection from termites often do.

DAVIAULT (L.). **Forest Entomology. Sixth annual Report for the Year ending March the 31st, 1943.**—*Rep. Dep. Lds For. Quebec 1942–43* repr. 11 pp., 1 fldg. map; also as *Contrib. For. Prot. Serv. Quebec* no. 21, 11 pp. Quebec, 1944.

This report of work in Quebec includes notes by R. Lambert (pp. 5–7) on forest insects in 1942 [*cf. R.A.E.*, A **32** 22]. Infestation of spruce by *Gilpinia hercyniae*, Htg., did not apparently increase [*cf.* **33** 223], but spread westwards north of the St. Lawrence. The regions in which it was observed in 1941 and 1942 are shown on a map. *Harmologa* (*Archips*) *fumiferana*, Clem., had been very injurious to balsam fir [*Abies balsamea*] and spruce in western Quebec and was spreading further to the east [*cf.* **33** 143]. *Paleacrita vernata*, Peck, and *Erannis tiliaria*, Harr., caused an average of 15–25 per cent. defoliation of maple groves and stands of mixed hardwoods; both these Geometrids were particularly abundant in the Chaudière region and the Quebec plains and attacked young trees more severely than old ones. The outbreak of *Pristiphora erichsoni*, Htg., on larch was declining, owing to parasitism by *Mesoleius tenthredinis*, Morl., and *Ptychomyia* (*Bessa*) *selecta*, Mg., and a disease of the larvae, but slight defoliation occurred in several regions; another sawfly, *Anoplonyx laricis*, Marl., frequently accompanied it and caused injury of some importance at one point. Other insects recorded comprise *Coleophora laricella*, Hb., which was abundant on larch in two regions, *Pissodes strobi*, Peck, which attacks the top shoots of young white pine [*Pinus strobus*] and sometimes red pine [*P. resinosa*] and spruce and was abundant in the region of Montreal, *Neodiprion lecontei*, Fitch, which was also injurious [to pine] near Montreal, *N. swainei*, Midd., which defoliated jack pine [*P. banksiana*] in several districts, *Phyllotoma nemorata*, Fall., which appeared to be spreading on birch in some regions, and *Serica tristis*, Lec., adults of which defoliated poplar and spruce in one locality.

M. E. Genest gives a brief report (pp. 7–8) on the results of inspections of sample plots, plantations and nurseries, in which he states that *Pissodes strobi* was injurious to spruce in some plantations and gives a list of insects that were found damaging ornamental trees.

G. Paquet, in a note (pp. 8–9) on work on parasite breeding and liberation, states that large-scale distributions of *Microplectron* [*fuscipenne*, Zett.], including examples of a strain adapted to low temperatures [*cf.* **30** 606], were continued and that smaller numbers of *Sturmia* sp. and *Exenterus* sp. were also released, all against *Gilpinia hercyniae*. *Microplectron* appeared to have become established in some of the districts in which it had been released during the preceding seven years.

R. Martineau (pp. 9–11) records the results of further research on bark-beetles and wood borers in areas that had been cut or burnt-over [*cf.* **32** 353]. In the cut-over areas, where 179 samples of spruce and 93 of *Abies balsamea* were examined, the stumps and logs were more intensely attacked by insects than the tops and branches. *Dendroctonus piceaperda*, Hopk., which was the commonest, attacked only stumps and logs, *Polygraphus rufipennis*, Kby., and *Ips borealis*, Swaine, occurred in all parts of the trees, and *Monochamus scutellatus*, Say, also attacked all parts, but preferred logs and tops. Covering the wood with green branches so as to hide it completely decreased attack by *D. piceaperda*, but increased that by *I. borealis* and *M. scutellatus*. Barking the wood caused pronounced desiccation and rendered it less liable to attack, but piling the different types of waste wood separately did not result in thorough desiccation and seemed to favour the development of insects. Observations in burnt-over areas showed that infestation was heavier in woodland that had been burnt in the spring of 1941 than in that burnt in 1940, and that trees burnt in spring were more attractive to insects than those burnt in summer. Most of the species of insects found were the same as those in the cut-over areas.

Seamans (H. L.). **A preliminary Report on the Climatology of the Wheat Stem Sawfly** (*Cephus cinctus* **Nort.) on the Canadian Prairies.**—*Sci. Agric.* **25** no. 7 pp. 432–457, 18 figs., 4 refs. Ottawa, 1945.

Cephus cinctus, Nort., was recorded in south-western Manitoba about half a century ago, and has since spread in a north-westerly direction across Manitoba and Saskatchewan and into Alberta. It causes severe losses of wheat in some years, but as it appeared that these years are not necessarily those in which it is most abundant, the influence of weather on its activities was studied. A dry hot May kills many of the overwintered larvae and the pupae and cold wet weather retards pupation and adult emergence in May and kills many of the adults in June, but the influence of weather is chiefly indirect and operates through the food-plant. If a stand of grass or wheat is uneven, most of the eggs are deposited in the stems in which development is most advanced, and mortality is then high, since one larva destroys all the other larvae and eggs in the same stem ; under these conditions in 1927, six of every seven potential larvae were destroyed. If the plants are rank and sappy owing to excessive precipitation during the growing season, the feeding of the larvae causes sap to exude into the stems, as a result of which many larvae are drowned ; in 1928, the percentage mortality from this cause was 30–50 and was lowest in crops sown on stubble, in which the growth was poorer than in those sown on summer fallow.

Laboratory and field investigations indicated that the increase of the sawfly is favoured by fairly high rainfall in autumn, followed by a mild winter, or one in which there is a protective covering of snow, and warm weather in May, June and July, with sufficient rain in each of these three months to promote even growth of the plants. In order to study this more closely, the temperature and rainfall records for ten crop years (ending 31st July) that resulted in marked increases in the abundance of the sawfly and ten that resulted in a marked decrease, which are given in tables, were examined. No correlation was found between the weather for any particular month or the total yearly precipitation and fluctuation in populations, but the averages for the two series of ten years are regarded as representing the most and the least favourable conditions. The previous conclusions as to favourable years were confirmed, and it was further concluded that unfavourable ones are those in which the autumn rainfall is low and winter temperatures show great fluctuations and in which May and June are wet and cool and July very wet or May and June are favourable, but drought occurs in July. A study of the development of the food-plant indicated that cumulative moisture exerts a greater influence than monthly precipitation, the most important periods being August–October and May–July. High precipitation during August–October provides a reserve of moisture in the soil that promotes even growth of the food-plants in spring, and consequently an even distribution of the eggs, and heavy precipitation during May–July induces sappy growth and high mortality of the larvae. The soil type is of importance, and local aberrations in correlation between precipitation and sawfly abundance were generally due to this factor.

The correlations of seasonal weather conditions with abundance of *C. cinctus* and of climatic conditions with its distribution in Canada are discussed with reference to hythergraphs in which temperature is plotted against total precipitation over three-monthly periods, and a map is given showing its present distribution in Canada, the areas in which it occurs and is likely to occur in injurious numbers, and the area in which outbreaks are common. Its distribution is likely to extend to the south-west in Alberta, but not to the north in Manitoba or Saskatchewan or to the west in Alberta north of Calgary.

It is concluded that accurate forecasts of the abundance of *C. cinctus* in any particular year should be based on precipitation, temperature and the actual moisture of the different soils, but that forecasts of some value can be based on the first two factors and the type of soil. An increase in population is likely when the mean temperature in August–October is 50–58°F., the total precipitation for the three months exceeds 3 ins. on heavy soil and 4 ins. on light, and the temperature and precipitation during May–July are 57–64°F. and under 6 ins. on heavy soil and 59–64°F. and under 7 ins. on light. On both kinds of soil, a decrease is likely when less than 5 ins. rainfall and mean temperatures of 46–57°F. in August–October are followed by more than 7 ins. rainfall and a mean temperature of 54–63°F. in May–July. The lower precipitation must accompany the lower mean temperature in all cases.

MARSHALL (J.). **Phenothiazine in Codling Moth Control.**—*Sci. Agric.* **25** no. 9 pp. 546–550, 7 refs. Ottawa, 1945.

The results are given of six years' orchard tests of phenothiazine sprays for the control of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in British Columbia; those obtained in 1937–38 and 1941–42 have already been noticed [*R.A.E.*, A **32** 147]. In 1943 and 1944, only micronised phenothiazine was used, and a hydrophilic colloid of casein and hydrated lime (1 : 9) was employed as the spreader. All spray quantities are given per 100 gals. In 1943, the percentages of apples infested and (in brackets) injured superficially were 7·6 (1) for five cover sprays of 1 lb. phenothiazine, 1 quart stove oil (viscosity 31·7 S.S.U., 86 per cent. unsulphonatable residue) and 4 oz. casein-lime, and 25·7 (4·4) for three cover sprays of 4 lb. lead arsenate followed by two of 4 lb. cryolite, each with 4 oz. casein-lime. In 1944, the percentages were 1·8 (0·6) for five cover sprays of 1 lb. phenothiazine and 1 quart stove oil and 5 (0·4) for five of ½ lb. phenothiazine and 1 pint stove oil, both with 3 oz. casein-lime, as compared with 2·8 (0·7) and 3·6 (1·1) on the corresponding plots treated with five sprays of 4 lb. cryolite and 4 oz. casein-lime. In the same year, they were 6·2–8·2 (4·6–4·8) for four cover sprays of 1 lb. phenothiazine and 1 quart stove oil or of ½ lb. phenothiazine and 1 pint stove oil or summer oil (viscosity 69 S.S.U., 77 per cent. unsulphonatable residue), all with 4 oz. casein-lime and followed by one cover spray of fixed nicotine and summer oil, as compared with 8·8–9·8 (7·4–8·8) for five sprays of 4 lb. cryolite, with 1 quart summer oil in the first three and 2 quarts in the last two. It was observed in 1944 that the phenothiazine sprays favoured the development of the mites, *Paratetranychus pilosus*, C. & F., and *Tetranychus pacificus*, McG., but this was counteracted by the use of fixed nicotine with summer oil for the last cover spray.

It is concluded that if micronised phenothiazine were available locally at a reasonable price, it could effectively replace lead arsenate in early sprays against *C. pomonella*, but that it is less suitable for use against the second generation, as late applications tend to affect fruit coloration.

ANNAND (P. N.). **Report of the Chief of the Bureau of Entomology and Plant Quarantine, Agricultural Research Administration, 19**[43–]**44.**—56 pp. Washington, D.C., U.S. Dep. Agric., 1945.

An account is given of work on insect pests and their control in the United States during the year ending 30th June 1944, some of which has already been noticed. In experiments against the codling moth [*Cydia pomonella*, L.] on apple in Washington, a spray containing dinitro-o-cresol gave 86–94 per cent. mortality of the hibernating larvae [*cf. R.A.E.*, A **33** 108] and reduced the subsequent infestation of the fruit by 25–50 per cent. In Indiana, repeated evening spraying with small quantities of nicotine sulphate killed many moths and reduced the injuries by 42 per cent. The number of properties infested by the pear psylla [*Psylla pyricola*, Först.] in the Pacific Northwest continued to decline as a result of the control campaign, and only minor extensions of the infested area were found [*cf.* **34** 74]. Infestations that were not obvious from visual inspection were discovered by the use of trap boards, 10 ins. long and 6 ins. wide, smeared on both sides with an adhesive; boards painted yellow were the most effective. The removal of abandoned pear trees and the treatment of pear regrowth [*cf.* **33** 22] reduced the number of properties that required spraying. During work on fumigation against the California red scale [*Aonidiella aurantii*, Mask.] on *Citrus*, tents made of fabric treated with plastic products [*cf.* **33** 259] retained 3–4 times as much gas during an exposure period of 45 minutes as the tents at present in use. The destruction of larvae of the hickory shuckworm [*Enarmonia caryana*, Fitch] in fallen pecan nuts by means of a disk tiller gave satisfactory results for the fourth successive season in experiments in Georgia [*cf.* **30** 590]; the percentage of infested nuts on two varieties was halved and the yield more than doubled.

DDT applied at rates of 5–27 lb. per acre to infested soils of several different types was as effective against larvae of the Japanese beetle [*Popillia japonica*, Newm.] as lead arsenate at 500 lb. per acre. Greenhouse studies indicated that although some crops were not injured by relatively large quantities of DDT applied to the soil, beans, spinach and tomatos were adversely affected by 25 lb. per acre.

An outbreak of the Engelmann spruce beetle [*Dendroctonus engelmanni*, Hopkins] has developed on Engelmann spruce [*Picea engelmanni*] in five National Forests in Colorado since February 1942. The losses due to it in two of the forests are estimated at 150 million board feet of timber, and 77·5 per cent. of the trees over an area of 2,227 acres in one had been killed. Conditions are favourable for continued damage, since about half the timber resources of Colorado and Wyoming consists of Engelmann spruce and much of it is mature or overmature. An extensive outbreak of the spruce budworm [*Harmologa fumiferana*, Clem.] killed or weakened large numbers of firs [*Pseudotsuga taxifolia* and *Abies* spp.], spruces and ponderosa pine [*Pinus ponderosa*] in the central Rocky Mountain region. Attempts to control it in special areas by spraying with lead arsenate had been only partly successful, but experiments in the spring of 1944 indicated that a spray of 1 lb. DDT per 100 U.S. gals. water is effective. Complete control of the gipsy moth [*Lymantria dispar*, L.] over 20 acres of woodland in Pennsylvania was obtained by applying DDT at the rate of 5 lb. per acre in the form of a concentrated spray distributed from an aeroplane by means of a specially constructed spinner-disk apparatus. The spray was applied on 3rd May 1944, when the leaves were beginning to unfold and the eggs had not hatched, and settled as a fine mist, which gave good coverage of the trees, undergrowth and forest floor and left a fine crystalline deposit of DDT. The larvae hatched but were killed on coming into contact with the deposit. The use of DDT permits an extension of the spraying period, since, owing to its residual effect, it can be applied perhaps a month or more before hatching. Fairly heavily infested woodland in New York was treated at the same rate when the leaves were fully developed and the larvae were in the second instar. No living individuals were found in either area up to the end of June. The same equipment was also used to apply a concentrated suspension of cryolite to infested woodland; it gave a fine uniform deposit that adhered well after rain, and control was fairly satisfactory. Lead arsenate applied in the same manner gave practically complete mortality.

Owing to unfavourable weather, infestation by grasshoppers in the Great Plains and Rocky Mountain States was considerably reduced and localised, but they were numerous in parts of California and Arizona where conditions were more favourable. Attempts to control the adults at oviposition sites late in the season of 1943 by means of poison bait gave promising results in

California and Montana, and the numbers of adults and eggs along roadsides and the margins of fields, which are important breeding sites, were greatly reduced by replacing broad-leaved weeds by grass. Six foci in which the Mormon cricket [*Anabrus simplex*, Hald.] persists at times when it is scarce elsewhere were discovered in Nevada, and one in Wyoming ; in these areas, hatching appears to be delayed by cold until so late in the spring that there is little likelihood of subsequent mortality due to adverse weather.

Intensive investigations showed that the Nematode parasites of the white-fringed beetles [species of *Pantomorus* of the subgenus *Graphognathus*] [**32** 194] are common both in and outside the infested areas, but are not of major importance in control.

Treating the silks of maize with atomised mineral-oil emulsions alone or with the addition of pyrethrins gave promising results against the corn earworm [*Heliothis armigera*, Hb.] and this method, which is less costly than application by injection [**34** 147], may be practicable for use on maize for canning. Fair control was given by a suspension of spores of the causal organism of a bacterial disease of *H. armigera* that was either sprayed on to the ears or injected into them ; this treatment did not interfere with pollination. Populations of the European corn borer [*Pyrausta nubilalis*, Hb.] on maize in 1943 were the highest recorded, and the infested area extended across central Kentucky and eastern Iowa and Missouri. Early sweet maize in the north of the infested area was in most cases entirely destroyed. Over 39,000 parasites of three species were liberated against *P. nubilalis* in ten States during 1943. Parasitism among larvae collected in the field in the autumn of 1942 varied from 16 to 69 per cent. and was highest in New Jersey.

A variety of wheat resistant to the Hessian fly [*Mayetiola destructor*, Say] and fungous diseases that was developed in Indiana [*cf.* **34** 4] gave a higher yield in experiments than two standard varieties.

In experiments against pests of stored cereals, white lead paint, whitewash and a solution of nicotine sulphate were all effective in preventing the cadelle [*Tenebroides mauritanicus*, L.] and the lesser grain borer [*Rhizopertha dominica*, F.] from entering the woodwork of grain bins and infesting grain subsequently stored in them. The addition to wheat of very small quantities of several dusts, including DDT and magnesium oxide, protected it from insect attack. Grain fumigants at normal dosages did not seriously impair the viability of wheat of which the moisture content was below 14 per cent. ; the baking quality of flour made from wheat of which the viability had been destroyed by fumigation was normal, but that of flour prepared from wheat that was not aerated after fumigation was reduced.

Losses in the yield of sugar due to infestation of sugar-cane by the cane borer [*Diatraea saccharalis*, F.] in Louisiana exceeded 200 million lb. in 1943. The sugar yield from susceptible commercial varieties was found to be reduced by 245 lb. per acre when they were heavily infested, whereas the yield from resistant ones was not affected. Cryolite dust applied either by ground equipment or from aircraft against the first-generation larvae gave up to 50 per cent. reduction in the population at harvest. Natural cryolite was in general as effective as the synthetic, and both were most satisfactory when applied undiluted. The West Indian sugar-cane mite [*Tarsonemus bancrofti*, Michael], which was thought to have been eradicated in 1941 [**33** 260], was again found to be well established at two places at Canal Point, Florida.

In California, large populations of the pea Aphid [*Macrosiphum onobrychis*, Boy.] did not develop early in the season in fields of lucerne in which grazing was continued until 1st March, though some were re-infested from ungrazed fields. Dusts of nicotine sulphate or of rotenone with either nicotine or an organic thiocyanate were less effective against this Aphid on peas than dusts containing rotenone as the only active agent. Basic copper arsenate was more effective against the tomato fruitworm [*Heliothis armigera*] on tomato than calcium arsenate or cryolite, though less effective than DDT. Sprays containing micronised phenothiazine or basic copper arsenate gave good results against the Mexican bean beetle [*Epilachna varivestis*, Muls.] and the Colorado potato beetle [*Leptinotarsa decemlineata*, Say], and in experiments in Ohio, dusts of ground derris or cubé root were as effective as dusts impregnated with rotenone against *E. varivestis*. Amyl salicylate in traps and poison baits for the adults reduced the infestation of tobacco by hornworms [*Protoparce*] in experiments in Tennessee, but was less effective in the flue-cured tobacco-producing areas of North and South Carolina.

The artificial defoliation of cotton by dusting the plants with calcium cyanamide as a measure against the boll weevil [*Anthonomus grandis*, Boh.] and other injurious insects again gave satisfactory results [*cf.* **33** 260]; an application of 10–20 lb. per acre caused complete defoliation within a few days provided that moisture was plentiful and the plants succulent. The addition of nicotine to calcium-arsenate dusts applied against *A. grandis* in order to prevent the increase in infestation by Aphids [*Aphis gossypii*, Glov.] that they cause increased the yield of seed cotton in Mississippi, Louisiana and Texas. In general, free nicotine, nicotine sulphate and several fixed nicotines were equally effective for equal amounts of actual nicotine, and control was satisfactory when the dusts were applied from aircraft or by ground equipment at any time during the day or night at which atmospheric conditions were favourable. Synthetic materials, including DDT, thiocyanates, phenothioxin and dinitro-o-cyclohexylphenol, did not give promising results against this Aphid. Cotton on fertile Delta soils tolerates Aphid populations as high as 60 per square inch of leaf surface in wet years, but in 1943, under dry conditions, populations of only half this size caused premature leaf-fall, and much lighter populations caused defoliation on drier soils.

Two winters favourable for hibernation have resulted in an increase of the pink bollworm [*Platyedra gossypiella*, Saund.] in the lower Rio Grande Valley, and the larvae were about twice as numerous on cotton in the spring of 1944 as in 1943. Of larvae in open bolls caged on 16th August, 18th September and 19th October, 0·75, 7·93 and 32·05 per cent., respectively, survived and of those in bolls on standing stalks, on the soil surface and in the soil at a depth of 4–6 ins., 26·44, 11·75 and 2·54 per cent. did so. The larvae evidently do not overwinter in free cocoons in the soil in this region. Infestation in the Big Bend area was favoured by high rates of survival during the winters of 1941–42 and 1942–43 and the longer planting period permitted in 1943 by the removal of legal restrictions, but was checked by the use of early-maturing varieties, the early cessation of irrigation and the removal of crop remnants after harvest. Where planting and irrigation were late, many long-cycle larvae were produced and the number of larvae entering hibernation was twice as great as in 1942. Observations with an instrument that measures soil humidity without disturbing the soil indicated that two or more irrigations separated by an interval in which the soil can dry out are necessary for successful pupation and adult emergence. In the field, a few moths emerge after the pre-planting irrigation, but others do not appear until after the first or second irrigation of the cotton, when squares and bolls are present. D-D (a mixture of dichlorpropylene and dichlorpropane) applied at the approximate rate of 50 U.S. gals. per acre killed 81–100 per cent. of the larvae in buried cotton bolls when injected into the soil to the same depth as the larvae at points about 18 ins. apart or when added to the irrigation water, but not when sprayed on to the surface of the soil after the bolls had been buried. The larvae were recorded for the first time overwintering in the seed-pods of *Pseudabutilon lozani*; infestation in secondary food-plants was correlated with their time of fruiting and the intensity of infestation on cotton.

Although survival of the cotton bollworm [*Heliothis armigera*] was high and oviposition heavy at the beginning of the season, damage was greatly reduced by subsequent high temperatures and natural enemies. At the same rate of application, a dust of cryolite diluted with 15–30 per cent. sulphur was as effective against the larvae as undiluted cryolite, probably because of its better dusting qualities and power of coverage ; greater dilutions were also effective, provided that the cryolite was applied at the rate of 8 lb. per acre. A dry-mixed bait of cryolite and maize meal (1 : 9) applied at rates of 40, 60 and 80 lb. per acre gave satisfactory control ; when it was applied by hand, even at the lowest rate, it covered the plants well and yields were equal to those from plants dusted with 8 lb. cryolite per acre. Two years' tests showed that control of *H. armigera* is increased by applying insecticides at rates higher than the usual 8 lb. calcium arsenate per acre. The respective increases in yield of seed cotton in lb. per acre were 173, 187 and 195 for calcium arsenate applied at rates of 8, 12 and 16 lb. and 195 and 300 for mixtures of basic copper arsenate and sulphur in the proportions of 1 : 2 and 1 : 1, both applied at the rate of 16 lb. Basic copper arsenate applied as a spray at the rate of 8 lb. per acre is stated to have been as effective as the 1 : 1 mixture or as calcium arsenate at 16 lb. Calcium arsenite was more toxic to the larvae than calcium arsenate, but is too injurious to the plants for general use. A dust of dinitro-o-cyclohexylphenol and sulphur (1 : 9) was less effective than calcium arsenate, and one of phenoxathiin [phenothioxin] and bentonite (1 : 1) was of little value.

Parasites imported into the United States from South America during the year included *Epiplagiops littoralis*, Blanch., *Porizonidea* (*Porizon*) sp. [*cf.* **34** 104] and *Triaspis* sp., which parasitise the vegetable weevil [*Listroderes obliquus*, Gylh.], *Pseudoarchytopsis* sp. from Uruguay and *Phorocera* sp. from Argentina against various armyworms, and *Actinoplagia* sp. and *Paniscus* sp. from Uruguay against *Heliothis armigera*. The predacious Carabid, *Calosoma argentinense*, Csiki, was also imported from Argentina against armyworms. Adults of *Hambletonia pseudococcina*, Compere, were received from Porto Rico for liberation against the pineapple mealybug [*Pseudococcus brevipes*, Ckll.] in Florida, and cocoons of *Cryptus sexannulatus*, Grav., which parasitises *Cydia pomonella*, and adults of *Allotropa utilis*, Mues., for trial against Comstock's mealybug [*Pseudococcus comstocki*, Kuw.], were imported from Canada. Shipments of *Eretmocerus serius*, Silv., from the Panama Canal Zone to the west coast of Mexico for use against the citrus blackfly [*Aleurocanthus woglumi*, Ashby] were completed [*cf.* **33** 261], and it has become established in infested plantations there. Consignments of *Aphelinus mali*, Hald., and *Lixophaga diatraeae*, Tns., which are parasites of the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] and *Diatraea saccharalis*, respectively, were also sent to Mexico, and puparia of *Theresia claripalpis*, Wulp (*Paratheresia diatraeae*, Brèth.), another parasite of *D. saccharalis*, were received in Porto Rico from Brazil.

Chemical investigations on insecticides are briefly reviewed.

COTTON (R. T.), FRANKENFELD (J. C.) & DEAN (G. A.). **Controlling Insects in Flour Mills.**—*Circ. U.S. Dep. Agric.* no. 720, 75 pp., 41 figs., 6 refs. Washington, D.C., 1945.

This is a revised and enlarged edition of a circular already noticed [*cf.* *R.A.E.*, A **25** 15 ; **26** 118]. Since infestation in flour mills frequently originates in the grain introduced, the insects that attack stored grain are discussed and control measures for use on the farm, in grain elevators and in warehouses are described. Details are given of the habits of insects found in flour mills, the means by which they may enter them and ways of preventing entry, and also of measures for controlling infestations that become established [*cf.* **31** 408]. In mills of modern construction, weekly cleaning out of stock from elevator boots and local fumigation of purifier, reel and flour conveyor every 3–4 weeks between general fumigations will keep infestations to a minimum. General fumigation with hydrocyanic acid gas, which has been the standard fumigant for flour mills for many years, methyl bromide [*cf.* **32** 99], which has been found to be highly efficient for the treatment of modern tight concrete, stone or brick mills, or chlorpicrin is described in detail, and local fumigation with chlorpicrin, hydrocyanic acid gas or a mixture of ethylene dichloride and carbon tetrachloride more briefly. Details are also given of the various methods of treatment with heat and of supplementary measures, including opening the mills during freezing weather, and resifting finished flour or flinging it by centrifugal force against steel pillars between revolving plates to kill the insects in it. Information on the control of infestations in warehouses by sanitation and by fumigation, preferably with methyl bromide, at atmospheric pressure, in a vacuum or under a tarpaulin, is followed by notes on means of protecting the flour after manufacture.

Entomology.—*Bienn. Rep. Okla. agric. Exp. Sta. 1942–44* pp. 63–71, 6 figs. Stillwater, Okla., 1944.

Dusts that controlled *Psallus seriatus*, Reut., on cotton in Oklahoma did not cause an increase in yield in 1943 and 1944, owing to dry weather. The effectiveness of sulphur against this Capsid was not improved by the addition of calcium arsenate or Paris green ; a dust containing 3 per cent. DDT in pyrophyllite was of no more value than sulphur against the adults, but gave better control of the nymphs. Severe injury to the leaves of cotton in June 1944 was found to be caused by *Empoasca fabae*, Harr., which reduced boll production by 47 per cent. in laboratory tests. *Diatraea grandiosella*, Dyar, which entered Oklahoma through the Panhandle in 1931, now extends over the western half of the State, where it reduces the yield of maize by up to 80–90 per cent. in some areas and occasionally develops in sorghums. Damage was reduced by planting in late March or early April in both 1943 and 1944.

MILLS (H. B.), CALLENBACH (J. A.) & REINHARDT (J. F.). **Montana Insect Pests, 1943 and 1944. Thirtieth Report of the State Entomologist.**—*Bull. Mont. agric. Exp. Sta.* no. 425, 30 pp., 6 figs., 8 refs. Bozeman, Mont., 1945.

The decline in grasshopper populations that began in Montana in 1939 [*cf. R.A.E.*, A **32** 214] continued in 1943 in counties east of the Rocky Mountains, over which *Melanoplus mexicanus*, Sauss., had spread in 1938 [*cf.* **28** 369] ; in the western counties an increase began at about the same time, and had become considerable in at least three of them by 1942. In general, *M. mexicanus* was the predominant species in both years, followed by *M. bivittatus*, Say. *M. packardi*, Scud., *M. differentialis*, Thos., and *M. femur-rubrum*, Deg., were of importance in several localities in 1943, and *M. differentialis*, which was first recorded in Montana in 1932 [**21** 229], was dominant in parts of 11 eastern counties in 1944. Hatching, which in 1944 was at first favoured by early drought, was prolonged in both years by cold weather, and in 1943 an average of 25 per cent. of the eggs was destroyed by Meloids and Carabids. Early cultivation for summer fallows was also of importance in egg destruction in 1943. Damage to autumn-sown wheat occurred late in the season, and has become more frequent with the increase in the growing of winter wheat in areas where strip-cropping is practised. Baits applied in spring and summer were not highly effective in either year, partly because of unfavourable weather and irregular development of the grasshoppers ; in 1944 they gave erratic results in cereals and grass and failed entirely in lucerne or where weeds were common. This may be attributed to changes in the feeding habits when relatively low grasshopper populations and abundant natural food replace high populations and a limited food supply. Baits applied in late summer and autumn, however, gave excellent control under almost all conditions. An attempt was made in the autumn of 1943 to reduce egg-laying by applying bait at the oviposition sites in one county, where, owing to early harvests, 50–75 per cent. of the eggs were deposited in weeds along the sides of roads, fields, etc. The results were so good that no application of bait was required in the following spring. The Mormon cricket [*Anabrus simplex*, Hald.] was nowhere of importance in 1943, and though the intensity and extent of infestation increased in 1944, control measures were still unnecessary.

Cephus cinctus, Nort., was abundant over considerable areas in the north-east and north-west of Montana in 1943 and extended its range in the north-west in 1944, when it was the most injurious pest of wheat. Infestation was highest in spring wheat, in which it sometimes approached 100 per cent.; it was about 10 per cent. in common varieties of barley in heavily infested areas, and flax was also attacked. On 18th July 1943, full-grown, active larvae were still present in 50 per cent. of the infested stubble in a field that had been attacked the previous year, and it is concluded that under certain conditions development may not be completed in one year. *Mayetiola* (*Phytophaga*) *destructor*, Say, caused localised damage in 1944 to wheat in eastern Montana, the only part of the State in which it is known to occur. It was recorded there for the first time in 1924, when it caused some damage, and appeared again in 1930, so that it is probably present each year. The conditions that enable it to become injurious are not known, but the outbreaks of 1924 and 1944 both followed three seasons in which precipitation had been above the average. *Harmolita tritici*, Fitch, infested wheat over an area of about 3,000 acres in 1943; in some cases 60 per cent. of the stems were attacked and the yield considerably reduced. The infestation had died out in 1944, possibly owing to autumn ploughing and burning, which was widely practised. Larvae of *Apantesis* (*Callarctia*) *blakei*, Grote, damaged winter wheat in one field in the latter part of April 1944. They had entered the field either from adjacent stubble or, more probably, from rangeland beyond it. They had fed over about five acres by 3rd May, but the young leaves were not entirely destroyed and good growing conditions enabled the wheat to recover completely.

The first recognised outbreak of *Paratrioza cockerelli*, Šulc, in Montana was in 1938 [**28** 370], when it reduced the potato crop by about 25 per cent. It occurred in smaller numbers until 1943, when it was not observed at all, but was present on potato, and possibly injurious, in some places in 1944. Examination by L. G. Gentner of a large collection of beetles of the genus *Epitrix* from Montana [*cf.* **33** 220] showed that *E. subcrinita*, Lec., which occurs on potato, tomato and crucifers, is the most abundant species present. Material from potatoes included one specimen of *E. cucumeris*, Harr., which is recorded from Montana for the first time.

A fairly extensive survey in 1944 in valleys in which peas are grown for seed and drying showed that *Bruchus pisorum*, L., is established only in one district, where the number of adults captured per 100 sweeps of the net varied from 2 to 14·5 and the crop in one field was known to have been destroyed. Some infestation had occurred in another county in 1943 and is thought to have been due to the use of infested seed, but the Bruchid had disappeared there by 1944, probably owing to a lack of suitable sites for overwintering. *Bathyplectes curculionis*, Thoms., was reared from larvae of *Hypera variabilis*, Hbst. (*postica* Gylh.), and had evidently accompanied its host as the latter spread into Montana from the south. *H. variabilis* is expected to be of only local and occasional importance on lucerne in Montana, owing to climatic limitations. *Aristotelia fragariae*, Busck, damaged strawberry plants at two places in the autumn of 1944; it had not previously been observed in the State. Larvae of *Lachnosterna* (*Phyllophaga*) *anxia*, Lec., attacked by a fungus of the genus *Xylaria* were received on 24th April from a place in southern Montana, where they were, apparently, quite commonly attacked by it.

WALKER (J. C.), LEBEAU (F. J.) & POUND (G. S.). **Viruses associated with Cabbage Mosaic.**—*J. agric. Res.* **70** no. 12 pp. 379–404, 6 figs., 6 refs. Washington, D.C., 1945.

An account is given of investigations in which the mosaic disease that occurs in cabbage in Wisconsin [*R.A.E.*, A **28** 321] was shown to be caused by two viruses, both of which were usually present in infected plants. They are here designated cabbage viruses A and B, and it is stated that they were also recovered from cabbages in western Washington. Transfers of virus were made by mechanical inoculation and by means of Aphids, which were allowed to feed on infected plants for 48 hours or more and were then placed on healthy ones. Virus B was found to be restricted to crucifers. Virus A also infected numerous other plants, including many Solanaceae ; in Chenopodiaceous and Amaranthaceous hosts some constituent of the extracted juice inactivated it and obscured its presence, so that recovery was made only by means of Aphids. In host-range, physical properties and symptoms, all of which are described, virus A resembled the cabbage black ring virus described from California by Tompkins, Gardner & Thomas and virus B resembled the cauliflower mosaic virus [*Marmor cruciferarum* of Holmes] described from California by Tompkins [**25** 756], which were studied comparatively in the same environment. It is suggested that cabbage virus A, cabbage black ring virus and cabbage ring necrosis virus [**30** 226] are strains of the virus described by Hoggan & Johnson [**23** 511] and classified as turnip virus 1 [*Marmor brassicae* of Holmes], that the cauliflower mosaic virus should be designated cauliflower virus 1, and that cabbage virus B and the broccoli virus of Caldwell & Prentice [**31** 228] are strains of it.

LEBEAU (F. J.) & WALKER (J. C.). **Turnip Mosaic Viruses.**—*J. agric. Res.* **70** no. 11 pp. 347–364, 8 figs., 24 refs. Washington, D.C., 1945.

The following is largely the authors' summary. In the course of investigations on cabbage mosaic in Wisconsin [*cf.* preceding abstract], turnips showing signs of virus infection were commonly observed. Three strains of virus (T6, T8 and T9) were isolated from them and another (T1) from turnips in experimental plots in Louisiana, and all four were compared with those of cabbage mosaic, *Brevicoryne brassicae*, L., and *Myzus persicae*, Sulz., being the vectors used. The symptoms that they caused in turnip are described. T8 was found to correspond very closely in properties and host range with the strain of turnip virus 1 described as cabbage virus A and with the black ring and ring necrosis viruses from cabbage. The others were similar in properties and breadth of host range, but differed from T8 and each other in host selectivity, none of them infecting cabbage, cauliflower, kale, brussels sprouts or annual stock (*Matthiola incana* var. *annua*), though all infected green sprouting broccoli. Only T9 infected kohlrabi and *Hesperis matronalis*, T8 and T9 infected all species of *Nicotiana* tested, T6 all but *N. rustica* and T1 only *N. glutinosa*, and that very mildly. All four infected zinnia, petunia and two varieties of beet, and all but T1 infected spinach.

It is pointed out that all the viruses that have been fully described from crucifers are infectious to turnip. The four strains described in this paper differ somewhat from each other and from other described viruses, but are considered sufficiently similar to turnip virus 1 to be regarded as strains of it.

HAWKINS (J. H.). **The Mexican Bean Beetle in Maine.**—*Bull. Me agric. Exp. Sta.* no. 431 pp. 205–231, 26 figs., 5 refs. Orono, Me., 1944.

The Mexican bean beetle [*Epilachna varivestis*, Muls.], all stages of which are described, was found in Maine in 1930 and was present in all the principal bean-growing areas of the State by 1944. An account is given of its bionomics and of the injury that it causes to beans and recommendations, based on recent investigations [*cf. R.A.E.*, A **33** 3, etc.], are made for its control by sprays and dusts, with details of apparatus suitable for applying them.

JEWETT (H. H.). **Life History of the Wireworm** *Conoderus bellus* **(Say).**—*Bull. Ky agric. Exp. Sta.* no. 472, 8 pp., 5 figs., 3 refs. Lexington, Ky., 1945.

Conoderus bellus, Say, all stages of which are briefly described, can be found throughout the year in fields of Kentucky bluegrass [*Poa pratensis*] in central Kentucky, and sometimes injures the bluegrass, and maize, *Lespedeza* and tobacco when they follow bluegrass in rotation [*cf. R.A.E.*, A **28** 367], but the larvae are so small that unless they are numerous, damage is slight except to seedlings and germinating seeds. Injury to tobacco is slight, as it usually occurs about 1st July, when the plants are of considerable size.

There is apparently only one generation a year. In cage tests in 1940, 1943 and 1944, eggs were deposited between early May and early August on the surface of the soil, under clods of earth, in crevices of the soil or on litter, but not on plants. They hatched in 6–11 days, and the larval and pupal stages and complete development lasted 20–47, 7–12 and 35–65 days. The newly-hatched larvae moved actively and bored into tender roots and soft sprouting grain. Pupation took place in the soil. The adults overwintered in the sod, becoming active on warm days in spring; no larvae lived through the winter, and no adults oviposited before overwintering or overwintered a second time. Since oviposition begins about 1st May, the land should be broken early to discourage it.

List of Intercepted Plant Pests, 1944.—*S.R.A., B.E.P.Q.* [1944] 37 pp. [Washington, D.C.] U.S. Dep. Agric., 1945.

This list of pests intercepted between 1st July 1943 and 30th June 1944 with plants or plant products entering United States Territory (including Hawaii and Porto Rico) resembles the four previous ones in the selection and arrangement of the data [*R.A.E.*, A **30** 556], but also includes short sections dealing with insects intercepted in aircraft and service mail, and, unlike the more recent lists [**31** 280; **32** 20; **33** 223], has no section on entomogenous fungi.

SEAMANS (H. L.) & ROCK (P. J. G.). **Starvation of the early Instars of the Pale Western Cutworm,** *Agrotis orthogonia* **Morr., and its Use in the Control of this Pest.**—*Canad. Ent.* **77** no. 4 pp. 57–61. Guelph, Ont., 1945.

Details are given of experiments in Alberta in 1935–36 in which it was shown that larvae of *Agrotis orthogonia*, Morr., can resist starvation for some time before, but not after they have begun to feed, and that if weed growth is allowed to begin and is then destroyed by cultivation 6–11 days before a cereal crop is sown, the larvae are reduced in numbers and do not damage the crop, whereas they cause serious injury if cultivation is immediately followed by sowing [*R.A.E.*, A **25** 754].

In further tests on a commercial scale in infested fields in 1937, crops on only 141 acres out of 9,615 in which there was an interval between cultivation and sowing and on 3,784 of 7,487 in which there was none were destroyed, the total percentage losses being 1·46 and 50·5, respectively. The greatest loss on any field in which sowing was delayed and the smallest on any other field were both 10 per cent. The most serious losses after delayed sowing were due to poor cultivation, which did not completely destroy the surface vegetation, and to the drifting of soil, which either brought cutworms into the field after the crop was up or prevented the growth of early vegetation, so that cultivation was completed before the young cutworms had begun to feed. In the spring of 1938, starvation control was widely adopted in southern Alberta, and although frequent rains rendered the destruction of weed growth difficult, the losses by 1st June were negligible, and many fields that had contained large populations of first-instar cutworms showed no losses. The treatment did not delay the sowing of the crop sufficiently to endanger the quality and quantity of grain secured and gave excellent control of weeds.

Wellington (W. G.). **Conditions governing the Distribution of Insects in the free Atmosphere.**—*Canad. Ent.* **77** nos. 1–4 pp. 7–15, 21–28, 44–49, 69–74, 2 graphs, refs. Guelph, Ont., 1945.

In the first three parts of this paper, the author discusses from the literature and his own observations in Canada the effect of atmospheric pressure, temperature and humidity, surface and upper winds and thermal convection, respectively, on the distribution of insects in the atmosphere. In the fourth, he discusses distributive processes of economic significance, and the following is his summary.

The distribution of insects by wind in the atmosphere occurs within the lower layers. Such distribution may be over a short or long range. Convection may carry insects to high altitudes, but distributes them over relatively short ranges at the surface. To establish a new insect colony of economic significance, a distributive process must combine the properties of steadiness in direction and lengthy duration. In this regard, long-distance distribution by wind usually may be neglected since it is an unsteady phenomenon, only occasionally delivering a few individuals of a given species to a suitable habitat. Short-range, high or low-altitude processes produced by local topography are of most significance economically. These processes are more or less fixed in direction, and are recurrent at short intervals. Thus, they may be responsible for the infiltration of a species in a relatively short time. It should be possible for entomologists to utilise the presence of such weather factors in planning the control of pest-species. It may or may not be necessary to call in local meteorologists for weather information.

Wilson (G. F.). **Insect Pests of** *Cotoneaster horizontalis*.—*J. R. hort. Soc.* **70** pt. 9 pp. 271–275, 3 pls., 1 map, 13 refs. London, 1945.

Notes are given on the habits and control of insects that infest the introduced ornamental shrub, *Cotoneaster horizontalis*, in Britain, based largely on observations at Wisley and on material received there. They comprise the Aphids, *Eriosoma lanigerum*, Hsm., and *Aphis pomi*, Deg., the Coccids, *Eulecanium* (*Lecanium*) *corni*, Bch., and *Lepidosaphes ulmi*, L., and the larvae of various moths. Plants trained on walls are often attacked by *Eriosoma lanigerum*, which overwinters on the branches in sheltered sites. The presence of large colonies checks growth and causes the development of small tumours and malformation of the shoots. Attempts to transfer this Aphid from *Cotoneaster* to apple or from apple to *Cotoneaster* after it had been reared for several generations on either plant were unsuccessful. Eggs of *A. pomi* were found on wall-trained plants in November 1921, but it is commoner on other species such as *C. frigida*. Both these Aphids can be controlled by spraying with 5 per cent. tar distillate in December, care being taken to direct it with force towards the inner sides of the branches, or by dusting with nicotine at temperatures above 65°F. in spring and summer. The tar-distillate spray also destroys the immature stages of *Eulecanium corni*, which hatch in July or August from eggs deposited during June–July and overwinter on the inner sides of the branches, but a spray containing ¾ fl. oz. nicotine and ¾ pint white oil in 10 gals. water applied during September–March is the most effective treatment against them. An application of this spray in late spring gives satisfactory control of *L. ulmi*, the overwintered eggs of which hatch in May.

Eggs of *Malacosoma neustria*, L., are deposited on the shoots in masses of 100–250 in late July and August, and hatch in late April and May. The larvae feed gregariously in silken shelters and pupate in cocoons on the stems, between the leaves and shoots, and in dry débris. This Lasiocampid can be controlled by collecting and burning the shelters. *Eurhodope suavella*, Zinck., was first found on *C. horizontalis* and *C. microphylla* at Wisley in June 1930. The adults occur in June–July, and the eggs are normally laid on hawthorn [*Crataegus*] and sloe [*Prunus spinosa*]. The larvae are present in silken galleries on the branches from September until May–June ; they sometimes cause severe defoliation in September–October, and, after overwintering, feed again in spring. Pupation occurs in the webs. Damage by this Pyralid may be confused with that due to *Scythropia crataegella*, L., the larvae of which feed gregariously in May–June in webs on the shoots, which are rendered unsightly by the webs and excreta. The pupae occur throughout the webs, and the adults emerge in the second half of June. The distribution of this Tineid on *C. horizontalis* is increasing, and it also infests *C. microphylla*. The leaves of *C. horizontalis* are also attacked by *Spilonota ocellana*, Schiff., the larvae of which hatch in August–September, overwinter in cocoons and feed again in spring, and *Ancylis achatana*, Schiff., which also attacks *C. microphylla* and normally feeds on hawthorn or sloe. Larvae of these four moths can be controlled by nicotine dusts applied on warm days in autumn or early spring and in the case of *Scythropia* before the webs become sufficiently dense to hinder the penetration of the vapour. Further damage can be prevented by a light application of an arsenical spray. DDT applied as a 5 per cent. dust or as an emulsion in oil was also of value in tests.

The counties in which *Eulecanium corni*, *Eriosoma lanigerum*, *S. crataegella* and *Eurhodope suavella* have been found on *C. horizontalis* in England and Wales are shown on a map. Three other moths, *Gelechia vepretella*, Zell., *Argyresthia sorbiella*, Tr., and *Depressaria cotoneastri*, Nick., have been recorded from this plant in continental Europe, and *Cremona cotoneastri*, Busck, was described from it in Oregon [*R.A.E.*, A **25** 429].

VAN DEN BRANDE (J.) & SWARTENBROEKX (J.). **De graanhalmwesp** (*Cephus pygmaeus* **L.**). [The Wheat-stem Sawfly (*C. pygmaeus*).]—*Meded. Landb.-Hoogesch. Opzoekingssta. Gent* **10** no. 1 pp. 3–10, 23 refs. Ghent, 1942. (With Summaries in French, German and English.)

VAN DEN BRANDE (J.). *Cephus*-**onderzoek. Vergelijking der halmen van aangetaste planten.** [Investigations on *Cephus*. A Comparison of the Stems of infested Plants.]—*T.c.* no. 3 pp. 182–193, 5 graphs. 1942. (With Summaries in French, German and English.)

In the first of these papers, the authors briefly describe the larva and adult of *Cephus pygmaeus*, L., give characters distinguishing this sawfly from other species of its genus and review from the literature its bionomics and the damage that it causes to wheat, other cereals and grasses in various parts of Europe. In observations in Belgium, the percentages of plants attacked were 2·66 and 3·16 for two samples of winter wheat, 7·5 and 7·78 for two of spring wheat and 4·95 for barley. Considerable control is afforded by parasites, of which the most important is *Collyria calcitrator*, Grav., and by burning the stubble or ploughing it under deeply.

In the second, an account is given of an investigation in Belgium in 1941 on the amount of damage caused by this sawfly to winter and spring wheat. Infestation had little effect on plant growth, but the average weight of the ears on infested stems was 1·28 gm. for the winter wheat and 1·61 gm. for the spring wheat, as compared with 1·48 and 1·69 gm., respectively, for those on normal stems. The number of seeds per ear was about the same for infested and uninfested stems, but the number per 100 gm. seed averaged 2,648 and 2,625 for infested stems of the two varieties, as compared with 2,136 and 2,263 for stems that were not infested.

MAYNE (W. W.). **Annual Report(s) of the Coffee Scientific Officer, 1938-39, 1939-40, 1940-41, 1941-42, 1942-43.**—*Bull. Mysore Coffee Exp. Sta.* no. 19, 16 pp. ; no. 21, 21 pp. ; no. 23, 17 pp. ; no. 24, 21 pp. ; no. 25, 19 pp. Bangalore, 1939–43.

These reports include accounts of work by V. K. Subramanyam in 1938–42 and by T. V. Pattabhiraman in 1942–43 on the bionomics and control of the coffee borer [*Xylotrechus quadripes*, Chevr.] in Mysore, and notes on the incidence of other insect pests. Observations were made in the first three years on the dates of emergence of adults of *X. quadripes* from infested stems kept in wire cages in the laboratory, during which the earliest date recorded was the third week in September and the latest the middle of December. In 1942–43, weekly records were kept from 1st October until 31st January of the beetles that emerged from 500 stems collected in the field and thought to be infested, half of which were placed in cages under open, sunny conditions and the rest set in the soil and kept under conditions of shade and high humidity. The total numbers of beetles that emerged from the stems kept in the open and those in the shade were 72 and 34, respectively, of which 49 and 17 emerged between 19th November and 9th December. Emergence continued from the week ending 28th October until that ending 23rd December from stems in the open, and from the week ending 4th November until that ending 20th January from the shaded stems. Measures directed against the eggs would therefore be of limited value if carried out earlier than December. It was found during the second year that the adults that emerge in April [*cf. R.A.E.*, A **22** 476] do so more frequently from young than from old plants.

In 1940, the beetles varied considerably in size, and six distinct types, differing in the coloration of the legs, were recognised. The smallest beetles, in which all the legs were black, produced few eggs, and the largest, which were the most numerous and in which the last two pairs of legs were red, were the most active and prolific. The smallest males mated readily with the largest females, but the reverse pairing was not observed. Males were slightly more numerous than females. The period for which the adults survived and their activity were both considerably reduced in 1940 by prolonged north-east monsoon rains and subsequent cloudy weather ; temperature appears to be the main factor influencing activity, though light and humidity are also important. In experiments in which fertilised females were caged with equal numbers of pieces of stems of *Coffea robusta* and *C. arabica*, 28 larvae were subsequently found in the stems of *C. robusta* and 51 in those of *C. arabica* ; both larvae and tunnels in *C. robusta* were smaller than those in *C. arabica*. In a similar comparative test, 182 larvae were found in *C. arabica* and only 46 in teak [*Tectona grandis*]. The tunnels in the latter were small and many larvae died soon after entering it, so that teak is unlikely to provide a reservoir of infestation. Oviposition studies in 1939–40 indicated that the number of eggs deposited is frequently greater than was previously reported [*loc. cit.*]. The eggs hatched in about ten days under fairly dry conditions, in 17 when kept in a moist chamber, and not at all when in contact with water. Eggs exposed in the field in 1940–41 developed normally and no parasitism was observed. The larvae appear to enter the wood after 2–4 days. Some 370 larvae were measured in July 1938 ; about 41 per cent. had attained their maximum length at that time, and the 13 per cent. that were still only half-grown may have hatched from eggs deposited during the hot weather.

In preliminary tests in 1938–39, cashew-nut shell oil applied to the stems of coffee caused no injury within four months of its application to trees 8–10 years of age, but the tops of 18-month-old plants dried off and the lateral branches died within 4–6 weeks, although treatment was restricted to the base of the stem. An emulsion of the oil was not injurious. Experiments in the following year, in which fertilised females of *X. quadripes* were caged round coffee stems that had been treated with the emulsion, which is stated to be an effective ovicide, showed that it did not repel the beetles and had no effect on eggs, larvae or subsequent infestation. Similar tests in 1938–39 indicated that a tar distillate (Mortegg) is of little value as a repellent. A suspension of Paris green, with or without a spreader, did not repel the beetles in 1940–41, and light-traps and cages containing males or females did not attract them. The effectiveness of scrubbing the stems to render them unfavourable for oviposition [*cf.* **26** 56] was confirmed in 1938–40. In field tests in 1939–40, the results of which were not conclusive, the application of an ovicide (Mortegg) was slightly more effective, whether accompanied by scrubbing or not, than scrubbing the stems alone, though all treatments gave some protection, and the ovicide was found to be more effective when applied between the end of October and the end of November than earlier or later. In 1941–42, only ten of 9,000 trees that were treated with Mortegg (1 : 19) and only 40 of 12,000 treated with other ovicides were subsequently infested. In an experiment described in the fourth report, the stems were scrubbed soon after the numbers of adults emerging in cages were observed to increase, so that the treatment might destroy eggs and young larvae. Two treatments carried out on 5th and 23rd November substantially reduced subsequent infestation.

X. quadripes was the most important pest of coffee in all the years under review, and in the report for 1938–39 its prevalence is attributed, at least in part, to decreases in the rainfall and the number of rainy days in November that occurred in several of the preceding years. A reduction in population due to the effects of the increased north-east monsoon rains in 1939 and 1940 was becoming noticeable by 1940–41. Attack by the green bug [*Coccus viridis*, Green] was severe on coffee in several districts during 1938–40, and is attributed to drought and to the consequent reduction of the entomogenous fungi that normally infest it. *Aularches miliaris*, L., fed on coffee and *Erythrina* in several areas in Coorg during 1939–42 and caused much damage locally. This Acridid is fairly common in Mysore and Coorg, and its bionomics there are much the same as in Ceylon [**23** 638, etc.], but it is only occasionally injurious. First-instar nymphs were very numerous on a few coffee bushes on an estate in March 1942. *Zeuzera coffeae*, Nietn., occurred on coffee on an estate in the Nilgiris in 1939–40, but caused little damage, and the robusta shot-hole borer [*Xyleborus morstatti*, Hag.] attacked stems of *Crotalaria anagyroides* in the Nelliampathies in 1941–42.

GUPTA (B. D.). **Effects of early Earthing-up of Sugarcane on the Attack of the Stem Borer,** *Argyria sticticraspis* **Hmpsn.**—*Indian J. agric. Sci.* **15** pt. 1 pp. 1–7, 3 refs. Delhi, 1945.

The results are given of experiments carried out at Muzaffarnagar, United Provinces, in 1936–38 and 1939–41 to study the effect of early earthing-up of sugar-cane on the incidence of *Proceras* (*Argyria*) *sticticraspis*, Hmps., the most important of the moth-borers during the hot weather of May and June, and on plant growth and yields [*cf. R.A.E.*, A **24** 242]. In the western districts of the United Provinces, sugar-cane is usually planted during March, the shoots appear 3–4 weeks later, and *P. sticticraspis* migrates to the plant crop from the ratoon crop after the middle of April. Infestation is confined to 2–8 per cent. of the plants until mid-May, but increases during the hot weather and is heavy until mid-July, after which it declines.

In preliminary tests in 1936, one earthing carried out by the middle of May reduced borer attack by 12 per cent., as compared with earthing up in August, and reduced tillering by 50 per cent., the number of canes formed by 28 per cent. and yield by 10 per cent. in comparison with the normal crop ; the individual weight of stems in the earthed-up plot was increased by about 20 per cent., and there was no material effect on the sugar content. When earthing-up was carried out before irrigation, most of the soil was subsequently washed down, and in later years earthing was carried out at the time of hoeing, after irrigation. Earthing on 16th May, 16th June and 16th July, on the last two dates only and on the last date only decreased borer attack by 40·7, 18·3 and 12·4 per cent., as compared with no earthing, in 1937 and decreased it by 18·8 and 8·1 per cent., and increased it by 3·5 per cent., respectively, in 1939, and earthing on 16th May, 1st June and 16th June, on the last two dates only and on the last date only decreased attack by 39·9, 41·1 and 15·4 per cent. in 1940. In that year, a final earthing up was carried out in all plots in August to prevent the crop from lodging during the rains. These figures include some infestation by *Emmalocera depressella*, Swinh., which could not readily be distinguished from that by *P. sticticraspis*.

Early earthing somewhat reduced the number of tillers and usually the total number of canes formed, the reductions increasing with the number of earthings ; it increased the yield of one variety by up to 16·9 and 13·3 per cent., respectively, in two years, and one earthing somewhat increased that of another in the third year, though two and three earthings decreased it slightly. Earthing up slightly decreased the percentage sucrose and the purity coefficient in 1939–40 and 1940–41, but in 1937–38, when the crop was poor in sugar content owing to severe attack by *Pyrilla*, the unearthed crop was the poorer, as it had lodged badly.

SENEVIRATNE (L. J. de S.). **Administration Report of the Acting Director of Agriculture for 1943.**—18 pp. Colombo, 1945.

Brief sections of this report [pp. D4–D5] deal with work on insect pests and plant diseases in Ceylon during 1943. Continued work on the biological control of the coconut caterpillar, *Nephantis serinopa*, Meyr., confirmed previous findings that no appreciable benefit is gained by releasing the Eulophid parasite [*Trichospilus pupivora*, Ferrière] between March and September [*R.A.E.*, A **32** 248], since it is apparently unable to withstand even for one generation the dry conditions then prevailing. A proprietary inert dust (Fygran A) was effective in reducing insect attack in grain stored in bags under normal conditions in the dry zone when mixed with the grain at the rate of 1 oz. per 2½ bushels. In tests of baits for the fruit-piercing moths, *Othreis* spp., ripe tomato fruits proved very attractive ; an undetermined species of *Apanteles* was found parasitising larvae of these Noctuids at Peradeniya. Other work included an investigation on a leaf-curl of tomato, caused by an unidentified mite [**33** 299].

BIRCH (L. C.). **The Mortality of the immature Stages of** *Calandra oryzae* **L. (small Strain) and** *Rhizopertha dominica* **Fab. in Wheat of different Moisture Contents.**—*Aust. J. exp. Biol. med. Sci.* **23** pt. 2 pp. 141–145, 2 figs., 4 refs. Adelaide, 1945.

The following is based on the author's summary of this account of further work at Adelaide on the effect of temperature and the moisture content of wheat on mortality in *Rhizopertha dominica*, F., and the small strain of *Calandra* *oryzae*, L. [*cf. R.A.E.*, A **34** 21]. Both were reared from egg to adult at different temperatures in wheat having different moisture contents, and the mortality of the immature stages was recorded. The maximum and minimum temperatures and the lowest moisture content at which there was any survival were 38·6°C. [101·48°F.], 22°C. [71·6°F.] and 9 per cent. for *R. dominica*, and 34°C. [93·2°F.], 15·2°C. [59·36°F.] and 10·5 per cent. for *C. oryzae*. The relations between temperature, moisture content of grain and mortality are shown on three-dimensional graphs. The mortality of *R. dominica* was uniformly low in grain of 12 and 14 per cent. moisture content at temperatures between 26°C. [78·8°F.] and 34°C., but was significantly greater at temperatures outside this range and in drier wheat. The moisture content of the driest grain in which it was able to develop fell as the temperature increased from 18·2°C. [64·76°F.] to 34°C. and rose again as it increased above 34°C. Survival was higher in grain that had been damaged, owing to the greater facility with which first-instar larvae were able to enter it and become established ; the percentage mortality was over 95 and over 60, respectively, in sound and damaged grain of 9 per cent. moisture content. The mortality of *C. oryzae* increased rapidly as the moisture content fell below 14 per cent. It was lowest at 30°C. [86°F.] for all moisture contents, and the moisture content of the driest grain in which there was any survival increased as the temperature increased above 30°C. or decreased below 18·2°C.

Almost all the mortality of the immature stages occurred in the first larval instar. In wheat with a moisture content of 14 per cent., which is the most favourable level for both beetles, the mortality of *R. dominica* was higher than that of *C. oryzae* within their respective medial ranges of temperature, but the difference between the mortality at 14 per cent. and at lower moisture contents was less for *R. dominica* than for *C. oryzae*.

MARSHALL (Sir G. A. K.). **On *Trephognathus* : a new Genus of African Baridinae (Col. Curc.).**—*Proc. R. ent. Soc. Lond.* (B) **14** pt. 1–2 pp. 21–24. London, 1945.

The four new species of weevils here described, for which the new genus *Trephognathus* is erected, include *T. apii* which is recorded as attacking celery in Senegal.

ISAAC (W. E.). **The Effect of Methyl Bromide Fumigation on Apples.**—*Fmg in S. Afr.* 1944 repr. no. 80, 7 pp., 4 figs., 8 refs. Pretoria, **1944.**

In view of the necessity for ensuring that apples exported from South Africa to Kenya and Rhodesia are not infested by *Cydia pomonella*, L., which is not present in those regions, experiments were carried out by R. G. Nel to determine suitable schedules for fumigating them with methyl bromide. It was found that exposure to a dosage of 2 lb. per 1,000 cu. ft. for 2 hours or to 1 lb. for 2, 6 or 12 hours was adequate for the destruction of eggs and larvae, though exposure to 1 lb. for 2 hours approached the limit of effectiveness. Investigations were then made to determine the effect of treatment with 2 lb. for 2 hours on apples of six varieties and of 1 lb. for 6 and 12 hours and 3 lb. for 6 hours on some of them. The apples were examined after storage for 4–6 weeks at 32, 35 or 45°F., and most of them again after further storage for 1–2 weeks at 65–70°F. Observations were also made on apples from consignments of some of these varieties and one other that were shipped to Southern Rhodesia after fumigation with 2 lb. methyl bromide for 2 hours or less [*cf. R.A.E.*, A **33** 127]. Treatment with 2 lb. for 2 hours caused no injury to two varieties, negligible injury to three others, and up to 25 and 50 per cent. injury to the remaining two. With one exception, in which the injury was the same, treatment with 1 lb. for 6 or 12 hours caused more injury to the varieties exposed to it. Treatment with 3 lb. for 6 hours damaged practically all the fruits, even of a resistant variety. The difference between the number of apples found to be damaged on removal from storage and after a further period at the higher temperature was variable. Ripening was stimulated in two of the more resistant varieties and to a slight extent in the two most susceptible ones. Two types of external injury and one type of internal injury were observed and are described and distinguished from other injuries that develop during storage. Internal injury was not always accompanied by external, nor external by internal, but internal injury was most frequent in apples of which the surface was also damaged. Large apples were more frequently damaged than small ones.

JONES (W. W.). **Methyl-bromide Fumigation of Papaya and Tomato.**—*Circ. Hawaii agric. Exp. Sta.* no. 17, 14 pp., 1 fig., 5 refs. Honolulu, 1940.

Fruits and vegetables exported from Hawaii to the United States must be subjected to specified treatments for the destruction of fruit-flies [*R.A.E.*, A **27** 344], and a treatment authorised for certain fruits is fumigation with methyl bromide at a dosage of 2 lb. per 1,000 cu. ft. for 3½ hours at atmospheric pressure and temperatures not lower than 80°F. [**29** 499]. In this paper, experiments on the effect of the fumigation on papayas and tomatos are described. The following is based on the author's summary and recommendations. The skin of fruit for treatment should be whole and unbruised. Papayas should be as ripe as possible, without being soft enough to be bruised by handling, and free from latent infections of anthracnose (*Colletotrichum* sp.), which is the chief cause of decay after they have been fumigated. The treatment reduces catalase action in papayas and causes a delay of 3–4 days in the ripening of firm-ripe fruits. They absorb and retain a small amount of methyl bromide, which slightly impairs their flavour. They should be placed in cold storage at 50–60°F. immediately after treatment. The ripening of tomatos is delayed for 3–6 days, depending on the maturity of the fruit, and their quality is not affected by the small amount of fumigant retained by them. Decay is not increased by the treatment of sound tomatos. Pink tomatos should be placed in cool storage at 55–60°F., as soon as they have been fumigated, and green tomatos as soon as they turn pink.

PARKER (R. L.). **Report on the Survey of the Insects and Pests attacking the Bermuda Cedar.**—5 pp. [Hamilton] 1945.

Notes are given on the insects and mites observed on Bermuda cedar [*Juniperus bermudiana*] in the Bermudas during a survey in March–June 1945. *Ormenis infuscata*, Stål [*cf. R.A.E.*, A **33** 289] was found in the early nymphal stages on 9th March and in the adult stage from 24th April to 15th June, indicating that there is one generation from the beginning of March to the beginning of June and possibly others during the summer. No eggs were found on the twigs, but this Flatid may have other food-plants, as nymphs and cast skins as well as adults were observed on olive, *Hibiscus*, sweet orange and other plants at the end of May, though their occurrence may have been accidental and due to dislodgement by driving rains. No parasites were observed. The eggs of the Geometrid, *Thamnonoma ochrifascia*, Warren (*Alcis verrillata*, Dyar) [*cf.* **28** 25] were not found, but the larvae were present on the trees from the beginning of April to the middle of June, and the pupal stage of one individual lasted from the latter part of April until 18th June. Two Coccids, *Chrysomphalus agavis*, Tns. & Ckll., and *Lepidosaphes newsteadi*, Šulc, were observed, the first of which is controlled by the parasites, *Aphytis* (*Aphelinus*) *diaspidis*, How., and *Aspidiotiphagus citrinus*, Craw [*cf.* **25** 786]. *Contarinia juniperina*, Felt, occurred sporadically in the middle areas of the islands and was less injurious than *O. infuscata*, possibly owing to parasitism by a species of *Inostemma* [*cf.* **34** 103]. An unidentified Aphid was collected during early April [*cf.* **33** 289], but disappeared later. The tarnished plant bug [*Lygus oblineatus*, Say], or an insect closely resembling it, was fairly numerous during April and possibly causes some of the extensive injury to the tips of the twigs [**33** 289] by injecting a toxin into the tissues on which it feeds. The Longicorn borers, *Oeme rigida*, Say (*linearis*, Harr.) and *Leptostylus praemorsus*, F., caused some damage, particularly to trees that were weak or unthrifty [*cf.* **30** 558], and various species of dry-wood termites attacked trees that had been injured. Unidentified mites were common on the trees in March and April, but did not cause evident injury to the leaves. Some that had been found previously have been identified as Oribatids and a Tyroglyphid, which fed on débris, and a species of *Cheyletus* predacious on other mites. No new gall formation by *Eriophyes* was observed.

Control measures recommended include the removal of weakened trees before 1st April to prevent attack by Longicorns ; treatment of pruning and other wounds with paint or a preservative to allow proper healing and discourage termite entry ; and spraying with an oil emulsion against Coccids, Aphids, *Ormenis* and possibly *Contarinia* between 15th March and 15th April, when *Ormenis* is in the nymphal and *Contarinia* in the larval stage. Lead arsenate should be added to the spray if *Thamnonoma* is present.

Callan (E. McC.). **Observations on Mole Crickets and their Control in Trinidad, B.W.I.**—*Trop. Agriculture* **22** no. 8 pp. 146–149, 8 refs. Trinidad, 1945.

Notes are given on the habits of mole-crickets, the injury that they cause and control measures that have been recommended against them in various countries. The two species that occur in Trinidad are *Scapteriscus vicinus*, Scud., which is a major pest, and *Gryllotalpa hexadactyla*, Perty, which is rarely abundant enough to cause damage there. A female of *S. vicinus* constructs three or four separate egg chambers in the soil, in each of which it deposits 30 or more eggs ; as many as 42 have been found in a single chamber. The nymphs hatch in 18–30 days and remain in the chamber for a few days without feeding. Development to the adult stage probably requires at least six months. Natural enemies in Trinidad include *Bufo marinus* and various lizards and birds. Sphegids of the genus *Larra* [*R.A.E.*, A **30** 515] occur rarely and exert little control. Mole-crickets sometimes congregate in large numbers round lights after heavy rain, especially in November and December.

In preliminary experiments on their control, based on a previous observation [**29** 374], emulsions of kerosene or ortho-dichlorbenzene watered on to lawns both caused the mole-crickets to come to the surface, where they can be collected and destroyed, but severely scorched the grass. None came to the surface following the application of a proprietary mixture of ortho- and para-dichlorbenzene in holes about 18 ins. apart, and as its repellent action depends on its volatility, it is unlikely to remain effective for long under tropical conditions. Protective collars, made by rolling large tough leaves of avocado, *Mammea americana* or *Eugenia malaccensis* into cylinders 3–4 ins. long and about 2½ ins. in diameter, gave good protection when sunk to a depth of 2–3 ins. in the soil round vegetable plants, either during or after transplanting. In experiments on poison baits, wheat or rice bran or crushed maize or rice all proved highly attractive and effective as diluents. In laboratory tests, baits containing 6 oz. Paris green, lead arsenate or calcium arsenate in 5 lb. bran or crushed grain, with water to moisten, gave mortalities of 75–80 per cent., and similar baits in which the toxic material was sodium fluoride, cryolite, sodium fluosilicate or barium fluosilicate gave mortalities of 80–90 per cent., but were rather slower in action ; mole-crickets that had eaten barium-fluosilicate bait showed a marked paralysis that spread from the abdomen throughout the body until the third or fourth day, when they died. Baits containing fluorine compounds appeared to be rather more effective than those containing arsenicals when applied to lawns, vegetable beds prior to planting and newly-planted beds of tomatos, cabbages and cauliflowers, and one containing sodium or barium fluosilicate at the concentration tested and applied at the rate of 20–30 lb. dry bait per acre is recommended. Baits containing 1½, 3 or 6 oz. metaldehyde in 5 lb. bran or crushed grain were eaten to some extent in the laboratory, but were not toxic. Instructions are given for preparing and applying the baits, with the precautions that should be observed during their use. They are best applied to the beds before planting and again after the plants are set out.

KELSHEIMER (E. G.). **Naphthalene Flakes keep Mole-crickets from Seedbeds.** —*Pr. Bull. Fla agric. Exp. Sta.* no. 611, [4] pp., 2 figs. Gainesville, Fla., 1945.

Much damage, especially in seed beds, has recently been caused in Florida by mole-crickets, of which the commonest of the four species present are the southern mole-cricket [*Scapteriscus acletus*, Rehn & Heb.] and the changa [*S. vicinus*, Scud.]. Notes are given on their appearance and habits [*cf.* *R.A.E.*, A **32** 154–155]. Owing to the ineffectiveness of poison-baits [*cf.* **31** 467 ; **32** 296] under field conditions, experiments were carried out with soil fumigants and repellents for use in seed beds, and promising results were given by naphthalene flakes. They should be applied to prepared seed beds at the rate of ¼ lb. per 10 sq. ft. and forked into the soil to a depth of 2 ins., after which the bed should be sprinkled with water at the rate of 1 U.S. gal. per 10 sq. ft. to make the soil retain the fumes. This treatment repels mole-crickets for at least six days, and a few flakes scattered between the rows of seedlings gives some further protection when they reappear. The treatment slightly delayed, but did not reduce, the germination of lettuce seeds in a bed that was surrounded by water, and in pot tests in which the water level was regulated, there was no difference in the germination of seeds in treated and untreated soil. Naphthalene is more effective in dry than in wet beds, and also repels ants.

TATE (H. D.) & BARE (O. S.). **The Southwestern Corn Borer.**—*Ext. Circ. Neb. Coll. Agric.* no. 1530, [4] pp., 5 figs., 1 map. Lincoln, Neb., 1945.

A light infestation of *Diatraea grandiosella*, Dyar, which has been spreading to the north-east in the United States [*cf.* *R.A.E.*, A **32** 340, etc.], was found in a few counties in south-central Nebraska in the autumn of 1943. Observations in 1944 did not indicate any increase in infestation, and it is possible that low winter temperatures may limit its northward spread. In view of its importance as a pest of maize in other States, notes are given on its bionomics and control in Kansas [*cf.* *loc. cit.*].

PAPERS NOTICED BY TITLE ONLY.

IMPERIAL INSTITUTE. **Quarterly Bibliography of Insecticide Materials of Vegetable Origin, Nos. 30–32 (January-September 1945).**—*Bull. imp. Inst.* **43** nos. 2–4 pp. 101–105, 219–224, 287–292. London, 1945. [*Cf.* *R.A.E.*, A **34** 32.]

BUTT (F. H.). **External Morphology** [of larva, pupa and adult] **of** *Amphimallon majalis* **(Razoumowski) (Coleoptera, the European Chafer).**—*Mem. Cornell agric. Exp. Sta.* no. 266, 18 pp., 13 pls., 16 refs. Ithaca, N.Y., 1944.